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MICROCOMPUTER ENHANCEMENT OF THE ARTICULATED TOTAL BODY (ATB) BIODYNAMIC MODELING SYSTEM

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This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER

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1. INTRODUCTION

1.1 BACKGROUND

The *Articulated Total Body* (ATB) model was derived from the *Three Dimensional Crash Victim Simulation* (3DCVS) which was originally conceived as a research tool to enable investigation of driver or occupant and motor vehicle interaction under various restraint configurations and other initial conditions during automobile crashes. Researchers at the U.S. Air Force Harry G. Armstrong Aerospace Medical Research Laboratory (AAMRL) adopted this model for the study of aircrew members during ejections from aircraft, with the view of eliminating or reducing injuries in a high acceleration environment. The use of modeling in this area of study is particularly appropriate and attractive since it reduces the cost of testing (whether with manikins or human subjects) and eliminates the risks associated with human testing. The modeling approach also supports system evaluations under operating conditions that would otherwise be infeasible to test with human subjects, and where the biofidelity of manikins is inadequate.

The *Three Dimensional Crash Victim Simulation* was developed by J. A. Bartz at the Cornell Aeronautical Laboratory for the U.S. Department of Transportation (DoT). The original model is a system of over 180 simultaneous ordinary differential equations programmed for solution by numerical integration, on an IBM mainframe. The 3DCVS model was improved by Fleck, Butler, and Vogel under further DoT sponsorship. Air Force motivated enhancements include the modeling of significant ~dblast forces during high speed ejections, and the modeling of complex, interacting-element restraint systems. Additional enhancements have included the development of significant graphic output capabilities to facilitate the analysis of results.

To facilitate the use of the model, additional application software has been written. These programs are GEBOD, VIEW, and CABS, which, together with ATB, comprise the ATB Modeling System (ATBMS). GEBOD prepares the body description for input to ATB using interactive inputs from the analyst. The VIEW program plots projected views of body position from the ATB simulation at constant time steps. CABS is used to compare tabular time history data files from

two ATB simulations.

The simulation, the numerical solution of the model, which was originally implemented on IBM mainframes, was adapted first to the CDC 6600 (another mainframe), and subsequently at AAMRL to the Perkin-Elmer 3250XP mini-computer.

1.2 OBJECTIVE

The ATB Modeling System is needed to address a variety of new technologies and challenges which are changing the operating environment of aircrews. These changes include increasing aircraft performance, which increase the need for expanding the safe ejection envelope. The increasing complexity of the weapon systems, cockpit, and missions have also stimulated the development of equipment to aid the aircrews -- night vision goggles, helmet mounted sights, and helmet mounted displays. Each of these devices has the potential for impacting the safe ejection envelope and increasing the injury potential of an ejection (as well as increasing the fatigue of normal flying). While microelectronics, fiber optic technology, and miniaturization can keep the equipment weight small, even these weights at 15 G ejection acceleration may pose a substantial injury hazard.

In view of the hazard potential of the technologies being introduced into the cockpit, exploration of their biodynamic effects is necessary. The use of the ATB Modeling System currently requires either costly mainframe computers, or a substantial minicomputer laboratory, which restricts its use at a time when computing technology is rapidly evolving, and is becoming available at the desktop level at an affordable cost. It is appropriate to reduce or eliminate the ATBMS analysis restrictions imposed by the present costly computer requirements in view of the needs of investigators in the DoD, industry, and the academic community to assess the consequences of new flightmission hardware developments.

Accordingly, this effort was undertaken with the objective of demonstrating the feasibility of using the Articulated Total Body Modeling System on readily available microcomputer systems.

1.3 REPORT OVERVIEW

Section 2 summarizes the results of this effort, with conclusions and recommendations. The system design criteria, hardware, operating system, and support software selections are described in Section 3. Section 4 discusses the software conversion and program execution. Supporting data are presented in the Appendices.

2. SUMMARY

2.1 RESULTS

The Articulated Total Body Modeling System was converted from the Perkin-Elmer 3250XP minicomputer to an Intel 80386/80387 microprocessor based personal computer under a Disk Operating System (DOS) environment. The design criteria, discussed in Section 3, were satisfied without compromises. The resulting hardware and software configuration suitable for using, or conducting further developmental work with, the ATBMS is also documented in Section 3. The results obtained on two sample cases using the microcomputer compare favorably with the results obtained from the Perkin-Elmer in terms of computational reproducibility. The results for comparison are presented in Appendices C3, C4, D3, and D4, respectively. The graphics capability presently in the ATBMS is also successfully replicated, as shown in Appendices E2, E3, F3, and G3.

The relevant hardware and performance characteristics of the computer systems used in this implementation are presented in Table 2-1. The significant differences between systems B and C are the presence of cache memory in system C and the clock frequencies of 20 *vs* 33 MHz. These two differences result in a three to one computational performance ratio, as indicated by both the Whetstone and Dhrystone measures. Two sample cases were used in comparing alternative hardware systems -- a basic sled test simulation (marked as example 1) and a dynamic joint test (example 2).

The execution timing results, summarized in Table 2-2, show that the 80386 system, operating with a 20 MHz clock, (80386/20, system B), is somewhat slower than the Perkin-Elmer. (System A is omitted from Table 2-2 due to insufficient memory for ATB execution.) However, the 80386/33 system (C) with cache memory is more than twice (2.17) the speed of the Perkin-Elmer. The comparison of two 80386 systems, at 20 and 33 MHz respectively, shows a performance ratio of slightly under three -- 2.79 and 2.95 for the two sample cases. These results are consistent with the systems' computational characteristics (3:1), which are slightly degraded by the I/O requirements. In view of the relatively high computation to I/O ratio of the ATB simulation the disk performance differences have only a slight impact.

Table 2-1. ATBMS Microcomputer System Comparisons

	SYSTEM A	SYSTEM B	SYSTEM C
HARDWARE CHARACTERISTICS			
Clock frequency - MHz	16	20	33.35
Memory, main, kb	640	640	640
Memory, extended, kb	1024	3456	7552
Memory, cache, kb	0	0	64
PROCESSOR PERFORMANCE[1]			
Dhrystones	3501	3793	11379
Whetstones, k	850.2	945.0	2933.8
PROCESSOR PERFORMANCE RELATIVE to 20 MHz SYS.			
Dhrystones	92	100	300
Whetstones	90	100	310
DISK PERFORMANCE[1]			
capacity, mb	70	348	150
track to track seek, ms	3.42	5.32	5.36
average seek, ms	25.3	13.0	20.4
transfer rate, kb/sec	33.6	182.0	35.2

1: processor and disk performance were measured using *CheckIt*, Ver. 1.10, TouchStone Software Corporation, Seal Beach, CA 90740.

Table 2-2. ATB Execution Time Comparisons

ATB PROBLEM	Perkin-Elmer 3250XP	Intel 80386/80387 20 MHz (B)	Intel 80386/80387 33 MHz (C)
		seconds	
1	291.45	395.79	134.29
2	30.91	38.67	13.84
		percent, relative to 3250XP	
1	100	136	46
2	100	125	45
		percent, relative to 80386/20	
1	74	100	34
2	80	100	36

For program compilation and linking Table 2-3 shows the results for a 80386/7 at three different clock frequencies -- 16, 20, and 33 MHz. The data indicate that the 33 MHz system is approximately 1.7 times faster than the 20 MHz processor at this task. This speed ratio is much lower than the value (~2.9) for execution. The difference in compilation and linking performance is probably due to the relatively large volume of I/O which is slower with the disk installed on the 33 MHz system. This hypothesis is supported by the performance differences between compilation and linking, with linking being slower than compilation, due to more disk accesses to the library to resolve references.

Table 2-3. ATBMS Compilation and Link Time Comparisons

PROGRAM	16 MHz (A)		20 MHz (B)		33 MHz (C)	
			seconds			
GEBOD	43	19	39	11	22	7
ATB	382	108	331	59	183	41
VIEW	41	54	35	32	19	22
			percent, relative to 80382/20			
GEBOD	110	173	100	100	56	64
ATB	115	183	100	100	55	69
VIEW	117	154	100	100	54	69
	compilation + linking percent, relative to 80386/20					
GEBOD	124		100		58	
ATB	126		100		57	
VIEW	142		100		61	

2.2 CONCLUSIONS

The results presented in Section 2.1 unquestionably demonstrate the capability of highly economical microcomputers for conducting both analytical and further developmental work with the ATBMS. The ATBMS conversion and execution results show that:

(a) production hardware, commercially available disk operating systems and support software comprise a suitable host for the ATBMS work,

(b) the demonstrated microcomputer host system performs without compromising the numerical accuracy or graphics capability of the ATBMS,

(c) the high performance microcomputer (Intel 80386/80387 based, with 33 MHz clock rate and cache memory) offers execution times markedly superior

to that provided by the Perkin-Elmer 3250XP minicomputer, and

(d) based on the hardware and software requirements established in the course of this study, the microcomputer-based ATBMS use is considerably more economical than the minicomputer alternative.

2.3 RECOMMENDATIONS

In view of the demonstrated results, which show that the microcomputer based ATBMS is both technically and economically superior to its earlier-technology minicomputer implementation, further enhancement of the 386 ATBMS is recommended. Some specific enhancement areas are described below, while a fully developed set of recommended changes will be documented separately.

The principal areas for ATBMS enhancements are user interface improvements (UII) and performance upgrades (PU). UIIs include the extension of the program-files interface, which was implemented for this phase with the introduction of DIRECTORY files, described in Section 4.2.5. The extension will retain the DIRECTORY file concept, but expand it to take advantage of the full DOS path support, which is supported by the compiler and linker. This extension should also enable simplification of both file naming/moving rules and the ATBMS directory structure.

Since some simulations may require considerable processing time, when a large number of segments and joints are simulated for a long interval, a display of the simulation progress would be useful. The in-progress display might show the present time interval, the segment or joint number, indicators of integration convergence history, percent completed, as well as lower and upper bounds of the time required to complete execution.

An enhancement area which bridges both UII and PU is the interactive construction and testing of simulation input files. This capability, which is partially implemented by the GEBOD program, should reduce the time and effort required to prepare and test ATB inputs. The significant features of such an interactive program would naturally include accurate file construction in terms of data field and record placement, but more importantly would test data in terms of units of measure selected, perform conversions, and display options in menu

format in English and translate the responses into appropriate switch/flag settings. Upon completion the program would test the resulting file for completeness to ensure that all data related to explicitly or implicitly selected options were present. Discrepancies would be flagged, with an opportunity to correct faults on-line, until a satisfactory input file was ready for simulation.

The two significant performance upgrades recommended at this time include graphics capability enhancements and the development of a post-simulation analysis package. The graphics upgrade would take advantage of relatively recent hardware and software developments to provide the analyst with high quality graphs, plots, and pictures, optimized to control processing time.

Postsimulation data extraction, reduction, analysis, and display are necessary in view of the large quantity of data produced by a single simulation, and by the need to correlate and compare -- statistically and graphically -- the results of several simulations, or simulation and test results. Such data handling software's principal features include the ability to review large quantities of data rapidly, select data from various (similar or dissimilar) sources for comparison, with a choice of filters and display formats selected interactively by the user. References [7, 8] document data analysis packages with such functional characteristics. These are presently used on CDC Cyber and HP computers respectively.

3. DISCUSSION

3.1 INTRODUCTION

This section of the report summarizes the technical issues relevant to the adaptation of the ATBMS to the microcomputer environment. Specific topics discussed include the design criteria, hardware configuration, operating systems, support software, and changes to the application software.

It should be noted that in the era of rapidly evolving microcomputer hardware and software, as well as peripherals (displays, bulk storage devices, hard copy devices), subjective judgements were made -- and revised --which "date" this report as it is being written. Nevertheless, the *method* used in development will stand the test of time, while the specific recommendations may change with time.

3.2 DESIGN CRITERIA

3.2.1 Hardware

In view of the overall objective -- to make the ATBMS readily available to investigators having limited resources -- it was a design criterion to select a hardware configuration that would provide acceptable ATBMS performance at reasonable cost, using standard, commonly and readily available hardware components. Hardware selection was further oriented toward systems whose continued support could reasonably be expected.

3.2.2 Operating System

An efficient, well known, commonly used operating system is desired that interacts with readily available support software, at an acceptable cost.

3.2.3 Operating/developmental Environment

It was a design criterion that the combination of hardware, operating system, support software, and application software should jointly constitute an environment appropriate to investigators in biodynamics, rather than microcomputer specialists.

3.2.4 Performance Times

In view of the computational intensity of the ATBMS, and particularly of the ATB simulation itself, an execution time not exceeding twice that of the Perkin-Elmer was desired.

3.3 HARDWARE CONFIGURATION

3.3.1 Selection Criteria

3.3.1.1 Processor, Memory, Clock

At the commencement of this project there were five classes of candidate microprocessor based systems potentially suited to the ATBMS application. These were the Intel 8000 based systems (IBM personal computers and their clones), the Motorola 68000 based Apple and Macintosh lines, microcomputers made by the Digital Equipment Corporation and by Hewlett-Packard (both using proprietary processors), and the various makes of "workstations".

The DEC and HP systems are not particularly common in general applications. The workstations, while offering the highest performance in the group, were significantly more expensive than other equipment. The Motorola 68000 based systems are not as common as the Intel systems and offer a smaller choice of support software.

Thus, by the process of elimination early in the project, the principal focus was on the Intel 8000 based systems. They appeared to be the most suitable due to their widespread use, which stimulates the commercial software vendors to develop and enhance the necessary support products. In view of the broad market base, continued hardware and software support can be reasonably expected. The Intel family of microprocessors also offers a range of performance capabilities through a choice between the 8086, 80286, and 80386 devices that are available at various clock frequencies, with their respective mathematical coprocessors. In view of the computational load posed by the ATB simulation, the Intel 80386/80387 processors are most suited to this application.

The ATBMS memory requirements are dictated by the ATB simulation, which is its largest component. Either sufficient memory has to be available to keep the program and data in memory during the entire execution, or a software

overlay approach has to be adopted. The in-memory alternative is preferred in view of the large volume of disk I/O needed for the overlay approach. Even with the substantial data transfer rates of high capacity disks, the system performance would suffer if overlays were used. The ATB simulation requires 4 Mb memory. The recommended processor supports up to 16 Mb of memory, which satisfies the preferred memory alternative.

The Intel 80386 processor is available in 16, 20, 25, and 33 MHz variants. It is clear from data presented above that increasing the clock frequency can significantly contribute to reducing execution times.

3.3.1.2 Display

While a very high resolution CAD type display is highly effective for viewing graphic output, a good quality EGA display is satisfactory for the ATB application.

3.3.1.3 Disk drives

Since most of the processing in ATBMS is computationally intensive, with a relatively low level of input/output activity, disk access time is not particularly critical. To accommodate the large output files, however, a disk of at least 70 Mb is recommended. Disks of that size typically are made with 28 ms access time, or less. Larger capacity disks would be recommended for high intensity analysis activity, particularly if frequent disk backups need to be avoided.

As software distribution and data handling media, floppy disks are the most common. User convenience would be well served if both common formats (5.25" and 3.5") were available.

3.3.1.4 Printer/plotter

The ATBMS can produce a large quantity of tabular output, as well as graphs. While a wide variety of printers and plotters are available, a single device -- a laser type printer -- can serve both as a high volume printer and a plotter. A printer operating at or above eight pages per minute is recommended.

3.3.2 Recommended Hardware

The hardware configuration recommended for ATBMS is summarized in Table 3-1.

Table 3-1. Recommended ATBMS Hardware Configuration

Item	Description
Processor	Intel 80386
Coprocessor	Intel 80387
Clock	33 MHz desirable
Memory quantity	4 Mb required
Cache memory	64 Kb
Memory speed	80 ns or less
Display	EGA or VGA
Disk drive capacity	70 Mb
Disk drive access	28 ms or less
Floppy disks	1.2 Mb, 5.25"
	1.4 Mb, 3.5"
Printer/plotter	Laser Jet type
	8 pages/minute, minimum

If computer-to-computer data transfer is desired, a modem (internal or external) can be added to the system. In view of the volume of data that is often generated by ATBMS, the analyst may find a tape-based backup system quite useful for archiving, particularly with a small hard disk and high analysis or developmental activity level.

3.4 OPERATING SYSTEM

3.4.1 Selection Criteria

Two operating systems are readily available for Intel microprocessor based systems -- the Disk Operating System, DOS, and variants of Bell Laboratories' UNIX system.

UNIX on a microcomputer offers two attractive features. First, all installed memory in the computer is directly available to the executing application. Second, microcomputer UNIX is available in a multiuser configuration.

This second feature is not of significant utility for the ATBMS implementation. In view of the computational load imposed by the simulation it is unlikely that the computer would be employed in a multiuser mode.

Since UNIX is not nearly as widely used as DOS, the quantity of available developmental software is somewhat limited, and is markedly more expensive than DOS software. Microcomputer users generally feel that UNIX based systems require more expertise and experience than DOS systems. Other attributes of the UNIX system will be discussed in Section 3.5, in conjunction with support software.

DOS presents two disadvantages in comparison with UNIX -- in conventional operations available application memory is limited to 640 Kb (regardless of amount installed), and the number of simultaneously open files within an application is limited to 15. These disadvantages, however, are alleviated by commercially available software packages which overcome DOS's built-in limits. Significant advantages to DOS are that it is well supported by a broad spectrum of commercially developed tools, which are typically less expensive than their UNIX counterparts -- when those counterparts exist. Furthermore DOS is well known not only to software developers, but also to application oriented computer users.

3.4.2 Recommended Operating System

Based on the above discussion, and observations presented in Section 3.5, DOS is the operating system of choice for the ATBMS implementation.

3.5 SUPPORT SOFTWARE

The term support software is used to cover compilers, linkers, graphics packages, and DOS memory extenders. These are all commercially available products necessary to complete the software portion of the hardware-software environment for ATBMS operation.

3.5.1 Selection Criteria

The support software selection was undertaken with the requirement to provide an efficient developmental/operating environment for the ATBMS. The

term efficient includes well documented, easy to use software, without the need for "work arounds" to solve potentially intractable problems. The operating environment has to be suitable to the problem-solving oriented application program user, rather than the dedicated, expert software developer.

It was also desired to minimize application software revisions, and to avoid new application development in order to fit the ATBMS to an operating environment.

3.5.1.1 The UNIX environment

When using a UNIX family operating system, reference [1], we found that UNIX based compiler/linker would not accept standard FORTRAN labelled COMMON specifications unless they were of identical length in each subroutine and function throughout the entire program. (Most compilers and linkers will process code -- with a warning -- as long as the longest COMMON is declared on its first occurrence. Shorter subsequent declarations are accepted without error.) This problem can be eliminated by suitably padding each COMMON declaration.

The second challenge posed by the UNIX operating system was the unavailability of a graphics support package capable of handling the CalComp graphics calls. CalComp (California Computer Products) is an old, well established X-Y plotter, which was available to the scientific applications community through FORTRAN CALL statements, which were supported by a dedicated load-time library. Their use became sufficiently widespread that "after-market" support libraries have been written for several devices, such as the TEKTRONIX terminals, and more recently for microcomputers. Such a library was not available for a microcomputer operating under UNIX.

Thus the available choices were either to modify the ATBMS to run under UNIX outputting data to a file, which would be post-processed under UNIX or DOS. The UNIX option would have dictated the development of special application programs to handle ATBMS graphics. The DOS option would also have required some custom software development, and the use of two operating systems to run the ATBMS, with some data moving between the UNIX and DOS file systems.

Based on the above, it is clear that using the UNIX operating system would have violated the established selection criteria.

3.5.1.2 The DOS environment

ATBMS implementation under DOS requires the simultaneously successful operation of the operating system and three support software elements. These are the compiler, the plotting library, and the DOS memory extender. The memory extender can be viewed as a memory driver that facilitates access to up to 4 Gb of installed memory, not only the first 640 Kb.

One support software collection included the *Phar Lap 386|ASM/LINK* memory extender, the *NDP Plot* plotter library, and the *NDP FORTRAN-386* compiler. The memory extender performed satisfactorily, while the plotting library failed to support its own demonstration example as documented. The significant deficiencies in the compiler included incorrect handling of real constants and incorrect handling of reserved keywords. Labelled COMMON is not checked for length, issues no diagnostic warnings, but misaligns COMMONs during execution. This software collection was deemed unacceptable for the ATBMS implementation. The software which satisfactorily supported the conversion effort is identified below.

3.5.2 Recommended Support Software

The *Lahey* compiler-linker, with the *AI Architects'* DOS extender, and *Plotworks* library, reference [2], were found to provide the necessary ATBMS implementation environment.

The DOS limitation on the number of simultaneously open files is eliminated by the *Lahey DOS Interface Library*, reference [3].

4. ATBMS IMPLEMENTATION

4.1 INTRODUCTION

This section provides the details of the ATBMS implementation in terms of support software organization requirements, compilation and linking procedures, and specific program modifications. The procedures for executing the individual programs are given. Examples of outputs and modified source code listings are provided in appendices.

It is assumed that the reader of this section is proficient in using Intel microprocessor based personal computers under the disk operating system.

4.2 SYSTEM CONFIGURATION

4.2.1 Hardware Configuration

The hardware configuration specified in Table 3-1 is assumed.

4.2.2 Support Software Configuration

The work presented in this report was carried out under MS-DOS versions 3.3 or 4.01.

The support software used -- compiler, plotting library, and DOS extender -- are identified in Section 5, reference [2].

4.2.3 Hard Disk Organization

The disk organization presented in this section was used to compile, link, and execute the ATBMS programs. While this is not the only possible organization, it follows a set of conventions that was used throughout the project. The conventions may be changed, but need to be kept consistent.

4.2.3.1 The boot directory

The boot drive root directory, C:\, contains the user's AUTOEXEC-.BAT and CONFIG.SYS files. The PATH established in the AUTOEXEC.BAT file must contain at least the following elements:

```
PATH=C:\;C:\DOS;D:\;D:\F77L3;D:\OS386;D:\PLOT88;D:\ATBM
```

4.2.3.2 The working drive

The root directory of the working drive, D:\, must contain the AI DOS extender configuration file, CONFIG.AIA.

4.2.3.3 The compiler directory

The Lahey FORTRAN-77 compiler is installed to directory D:\F77L3.

4.2.3.4 The DOS extender directory

The DOS extender directory, D:\OS386, contains the files installed for A.I. Architects' OS/386. The DOS extender is a subset of the A.I. Developers Kit OS/386, and it may be packaged with the Lahey compiler. The complete Developers Kit is not required.

4.2.3.5 The graphics directory

The plotting library is placed in directory D:\PLOT88.

4.2.3.6 The working directory

The working directory employs the following naming conventions:

.BAT are batch files, used for compilation and linking

.FTN are FORTRAN source files

.EXP are executable files generated by the compiler

.DIR are directory files used for file handling by GEBOD, ATB, and VIEW discussed in Section 4.2.5

Also included in the working directory are:

- input files required for execution by GEBOD, ATB, and VIEW, specified in the corresponding .DIR file
- output files generated during program execution
- RPCSLAVE.EXE supplied with PLOT88, required for execution.

The object code, map, and listing files may be deleted or kept, at the discretion of the user.

4.2.4 Compiling and Linking FORTRAN

The executable program, .EXP, is generated from the source code by

the compiler and linker programs. Two batch files have been prepared, their use depending on the presence or absence of graphics calls in the source code. In either case, compilation listings are generated with the same name as the source code file, using a .C extension. Following successful compilation, the batch files proceed by linking object modules, using the graphics libraries, as appropriate.

The GEBOD program, which does not utilize graphics, is compiled and linked by CL.BAT:

```
F77L3 %1.FTN %2 /7/nS > %1.C
UP L32 %1
```

The compilation/linking is invoked as:

```
CL GEBODII
```

The ATB and VIEW programs, both utilizing graphics, are compiled by CLL.BAT:

```
F77L3 %1.FTN %2 /7/nS > %1.C
UP L32 %1,,,\PLOT88\PLOT88+\PLOT88\DRIVE88+\F77L3\F77L3
```

The compilation/linking is invoked as:

```
CLL ATBIV  or  CLL VIEWPE
```

Additional compiler options, such as debug, cross reference listings, etc. may be added as a second element (without embedded blanks) following the program name for either batch file.

The ATB program source code, due to its large size, is usually transferred on floppy disks as four files. This also facilitates code modifications, since most conventional text editors will not process very large text files. The compilation and linking procedure (CLL.BAT) is, however, for a single source file. The user has the option of either developing multiple file compilation and linking procedures, or combining the four ATB source code files prior to compilation with the ACOPY.BAT procedure:

```
COPY ATBIV.FT1+ATBIV.FT2+ATBIV.FT3+ATBIV.FT4 ATBIV.FTN
```

Similarly, the large data file which is input to GEBOD, is stored in two segments on floppy disks. The segments are combined by the GCOPY.BAT procedure:

COPY GEBOD.DT1+GEBOD.DT2 GEBOD.DAT

4.2.5 ATBMS *DIRECTORY* Files

The purpose of the DIRECTORY files in the 386-ATBMS implementation is to identify the input files, provide names for the output files, and initialize hardware devices -- displays, printers, and plotters. The alternative of having fixed file names and hardware devices embedded in the FORTRAN source code would have been unacceptably inflexible.

The file name records in the directory file follow the format:

field 1: characters 1-12, left justified, valid DOS filename, required

field 2: characters 15-21, FORTRAN logical unit designator, optional, recommended

field 3: characters 25-80, file use description or comments, optional, recommended

The device initialization records in the directory file follow the following format:

field 1: characters 1-4, right justified, numeric, PLOT88 PLOTS parameter value, required for device parameter initialization

field 2: characters 7-12, alphanumeric, PLOTS parameter name, optional, recommended

field 3: characters 15-21, alphanumeric, FORTRAN logical unit designator (when used), optional, recommended

field 4: characters 25-80, alphanumeric, comments, optional, recommended

The following are the general rules for all DIRECTORY files:

(1) The names of the DIRECTORY files may not be changed, they are GEBODII.DIR, ATBIV.DIR, and VIEWPE.DIR, respectively.

(2) The SEQUENCE of records in the DIRECTORY files is critical. Records MUST NOT be deleted! Records MUST NOT be interchanged!

(3) All output files are conservatively opened with STATUS=NEW. This prevents these files from being overwritten. To obtain a second or subsequent execution, the analyst has the following options, one of which MUST be exercised:

(a) delete the output files,

(b) rename the output files,

(c) move the output files to a different DOS directory,

(d) copy the output files to a different DOS directory, then delete the originals, or

(e) edit the DIRECTORY file, assigning new names to the output files.

The DIRECTORY files specific to each program are described in Section 4.3.

4.2.6 Executing Programs

An executable file (.EXP) is produced by the compilation and link steps for each ATBMS program. Each program has its corresponding DIRECTORY (.DIR) file which identifies input/output file names and hardware device parameters. The .DIR file is prepared or modified by using any ASCII text editor. With the executable (.EXP), directory (.DIR), and input files in the current working directory, the programs are executed by the command

UP GEBODII, UP ATBIV, or UP VIEWPE

4.3 PROGRAM IMPLEMENTATION

The specific changes incorporated into each program, their DIRECTORY files, and sample outputs for each are described in the balance of this section. All source code modifications are identified by the string 80386 starting in character position 73.

4.3.1 The GEBOD Program

The modified GEBOD program (reference [4]) source code is provided in Appendix H.

4.3.1.1 Source code modifications

The following source code changes were made for the 386-GEBOD implementation.

(1) Changes to COMMONs, to achieve equal length across all subprograms

(a) /DIMS/ in MAIN, CONTAC, SEGMAS, TORSO, FEET, RESULTS, CNVERT

(b) /FLOAT/ in MAIN, CONTAC, SGINER, TORSO, FEET

(c) /NAMES/ in BLOCK DATA, PTILE, RESULTS, RESULTZ

(d) /JNTS/ in CONTAC, SEGMAS, CNVRT

(e) /SGMNTS/ in SGINER

(2) Accessed the directory file GEBODII.DIR and opened the appropriate files in MAIN and DIALOG.

(3) Reduced real constant exponent from E+74 to E+38 in subprogram NDTRI.

(4) Modified EXTERNAL calls to ELLIP in subprogram SEGMAS,

(5) Modified EXTERNAL calls to ELLPMI in subprogram SGINER, and

(6) Modified ABEVAL calls in subprograms ELLIP and ELLPMI. Changes 4 through 6 were necessary since the present version of the compiler does not support the EXTERNAL statement.

(7) Removed case sensitivity from user responses in subprograms DIALOG, RESULTS, and RESULTZ.

4.3.1.2 The GEBODII.DIR file

The general rules discussed in Section 4.2.5 apply to GEBODII.DIR. A sample if this directory file is shown below.

```
GEBODII.DIR
GEBOD.DAT      UNIT 2    GEBOD INPUT
GEBOD.AIN      UNIT 3    GEBOD BODY DESCRIPTION OUTPUT, INPUT TO ATB
GEBOD.TAB      UNIT 9    GEBOD BODY DESCRIPTION TABULAR OUTPUT
GEBODIN.USR    UNIT 1    USER-SUPPLIED GEBOD INPUT, 4(8F10.3) RECORDS
```

Comments:

(a) The body description tabular output file (unit 9) contains carriage control characters and may be printed directly.

(b) The user supplied input file (unit 1) is opened only if the appropriate option is selected during program execution. If this file is not used, then the corresponding field may be left blank, but the record must be present.

4.3.1.3 Sample outputs

The GEBOD program outputs, which is the body description in tabular form (GEBOD.TAB) and in ATB input form (GEBOD.AIN), are shown in Appendices A and B, respectively.

4.3.2 The ATB Program

The modified ATB program (reference [5]) source code is provided in Appendix I.

4.3.2.1 Source code modifications

The following source code changes were made for the 386-ATB implementation.

(1) Changes to COMMONs, to achieve equal length across all subprograms

(a) /CDINT/ in BLOCK DATA, ADJUST, CMPUTE, DINT, HICCSI, POSTPR, RSTART, TRIGFS.

(b) /TEMPVS/ in

BLOCK DATA,	AIRBAG,	AIRBGG,	AIRBG1,	AIRBG3,
BELTG,	BELTRT,	BGG,	BINPUT,	BLKDTA,
CHAIN,	CINPUT,	DAUX,	DAUX11,	DAUX12,
DAUX22,	DAUX31,	DAUX32,	DAUX33,	DAUX44,
DAUX55,	DRIFT,	EJOINT,	EQUILB,	FDINIT,
FINPUT,	FLXSEG,	HBELT,	HBPLAY,	HEDING,
HINPUT,	HPTURB,	HSETC,	HYEST,	HYLPX,
HYNTR,	IMPLS2,	INITAL,	KINPUT,	OUTPUT,
PDAUX,	PLEDG,	PLELP,	PLSEGF,	PLTXYZ,
POSTPR,	PRINT,	PRIPLT,	ROTATE,	SEGSEG,
SETUP1,	SETUP2,	SINPUT,	SPDAMP,	UNIT1,
VINPUT,	VISPR,	WINDY.		

(c) /TITLES/ in KINPUT.

(d) /CNSNTS/ in POSTPR.

(2) Accessed the directory file ATBIV.DIR and opened the appropriate files in MAIN.

(3) Removed Perkin-Elmer CARCON command in subprograms MAIN, HEDING, and OUTPUT.

(4) Modified system clock calls in subprogram ELTIME.

(5) Modified PLOTS call in subprogram POSTPR, and

(6) In subprogram SLPLOT modified the declaration of COMMON /TEMPVS/ variables passed as arguments from subprogram POSTPR. Changes 5 and 6 were necessary for compatibility with the PLOT88 package.

(7) Modified SYMBOL call in subprogram SLPLOT.

4.3.2.2 The ATBIV.DIR file

The general rules discussed in Section 4.2.5 apply to GEBODII.DIR. A sample of this directory file is shown below.

```
ATBIV.DIR
ATB.TP1        UNIT  1   ATB OUTPUT, VIEW BODY ELEMENT AND CONTACT PLANE INPUT
ATB.PRP        UNIT  2   ATB PRINTER PLOTS
ATB.ROU        UNIT  3   ATB RESTART RUN OUTPUT FILE
ATB.RIN        UNIT  4   ATB RESTART RUN INPUT FILE
ATB.AIN        UNIT  5   ATB INPUT, GEBOD BODY DESCRIPTION OUTPUT
ATB.AOU        UNIT  6   ATB PRIMARY OUTPUT FILE
ATB.TP8        UNIT  8   ATB SUBROUTINE POSTPR OUTPUT FILE
   0  IDEF     UNIT 10   DRAWING OPTION            SEE PLOT88, 3.1
  91  IOPORT   UNIT 10   HARDWARE INTERFACE 91/ 1  SEE PLOT88, 3.1
  91  MODEL    UNIT 10   OUTPUT DEVICE      91/64  SEE PLOT88, 3.1
ATB.T24        21 - 85   LAST ATB TABULAR TIME HISTORY OUTPUT FILE (21-85)
```

Comments:

(a) The ATB printer plots, primary output file, and tabular time history files (units 2, 6, and 21-85) contain carriage control characters and may be printed directly.

(b) Optional files are not OPENed during execution unless the corresponding features have been selected in the input file. When optional files are not used, their name fields in the .DIR file may be left blank. However, the record position in the file must be retained! The following files are optional during ATB execution:

UNIT	APPLICATION
1	VIEW input
2	printer plots
3	RESTART run output
4	RESTART run input
8	POSTPR output
10	X-Y plots
21-85	tabular time history output

(c) When tabular time history output files (units 21-85) are selected, the last ATB directory entry must contain a valid DOS file name, with a three character extension. The second and third characters of the extension are used to specify the last logical output unit (21-85) used for tabular time history data. As an example, if tabular time history data are to be output on logical units 21 through 46, then the last entry should read cccccccc.c46, where

"c" represents any legal DOS file name character.

4.3.2.3 Sample outputs

Two sample cases, provided by AAMRL/BBM were used to test the 386-ATB implementation, and to develop the performance statistics presented in Table 2-1. Appendix C presents the inputs and outputs for the Basic Sled Test Simulation, with C1 and C2 listing the input and directory files, and Appendix C3 showing the 386 output. To facilitate comparison between the 386-ATB results and those obtained on the Perkin-Elmer, Appendix C4, showing the Perkin-Elmer results is provided. Similar appendices (D1-D4) are used for presenting example 2, the Dynamic Joint Test.

The input file for example 2 was modified to demonstrate both the X-Y plot and the printer plot capability of the 386-ATB. Appendix E1 shows the modified input file, while samples of the resulting plots are in appendices E2 and E3, respectively. The output is identical to the one shown in Appendix D3, with an increase in execution time to 43 seconds, due to the plotting options.

4.3.3 The VIEW Program

The modified VIEW program (reference [6]) source code is provided in Appendix J.

4.3.3.1 Source code modifications

The following source code changes were made for the 386-VIEW implementation.

(1) Changes to COMMONs, to achieve equal length across all subprograms
   (a) /PLTT/ in EXTEND, PLPLN, PNTPLT.
   (b) /DBUG/ in INPUT.

(2) Modified hexadecimal constant assignments in subprogram NFRAME.

(3) Accessed the directory file VIEWPE.DIR and opened the appropriate files in MAIN.

(4) Moved code blocks following the statement numbers 200 and 400 within the DO-100 loop in subprogram PNTPLT to avoid external transfer into the DO-loop range.

(5) Changed NEWPEN calls to COLOR calls in subprograms MAIN, PLPLN, and

TITLE for compatibility with the PLOT88 package.

(6) Modified the MAIN program to ignore device flag, DEVFLG, specified on record 1 of the control data input file. The device flag is now set to 4, for a multicolor graphics terminal.

(7) Added a scale factor in the MAIN program to allow display of the 20-character title on the graphics screen.

(8) Modified calls to SYMBOL and NUMBER in program MAIN to display frame titles on the graphics screen.

(9) Inserted a test on variable TEMP in subprogram ELIPSN. This test is needed due to differences in precision between computers.

(10) Replaced PLOTS call with PLOT call in subprogram NFRAME for compatibility with the PLOT88 package.

4.3.3.2 The VIEWPE.DIR file

The general rules discussed in Section 4.2.5 apply to VIEWPE.DIR. The output listing file (unit 6) contains carriage control characters and may be directly printed. A sample of this directory file is shown below.

```
VIEWPE.DIR
VIEW.TP1       UNIT 1    VIEW BODY ELEMENT AND CONTACT PLANE INPUT, ATB OUTPUT
VIEW.VIN       UNIT 5    VIEW CONTROL DATA INPUT
VIEW.VOU       UNIT 6    VIEW LISTING OUTPUT
   0  IDEF               DRAWING OPTION               SEE PLOT88, 3.1
  91  IOPORT             HARDWARE INTERFACE 91/ 1     SEE PLOT88, 3.1
  91  MODEL              OUTPUT DEVICE      91/64     SEE PLOT88, 3.1
```

4.3.3.3 Sample outputs

The two samples used for testing the 386-VIEW program implementation are ATB course examples 1 and 2. The input files, the output listings, and the resulting graphics are shown in Appendices F and G, respectively.

5. REFERENCES

1. Microport System V/386 Runtime System, Version 3.0e
   LPI-FORTRAN for Intel 80386 UNIX System V, Version 3.02

2. Lahey compiler-linker F77L-EM/32
   Lahey Computer Systems, Inc., Incline Village, NV
   AI Architects' DOS extender OS/386
   Lahey Computer Systems, Inc., Incline Village, NV
   Plotworks PLOT88 library
   Plotworks Inc., Ramona, CA

3. Lahey Spindrift Utility Library (for F77L-EM/32)

4. Baughman, L.D., *Development of an Interactive Computer Program to Produce Body Description Data*, Technical Report AFAMRL-TR-83-058, WPAFB, OH, July 1983.

5. Obergefell, L.A., Fleck, J.T., Kaleps, I., and Gardner, T.R., *Articulated Total Body Model Enhancements*, Three volume Technical Report AAMRL-TR-88-007, -009, -043, WPAFB, OH, January, 1988.

6. Leetch, B.D. and Bowman, W.L., *Articulated Total Body (ATB) "VIEW" Program Software Report, Parts I and II*, Technical Report AFAMRL-TR-81-111, WPAFB, OH, June 1983.

7. D'Aulerio, L.A., Frisch, G.D., and Fender, D.A., *Ejection Test Data Analysis Package (ETDAP) User's Guide*, Report No. NADC-84133-60, Warminster, PA, October 1984.

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APPENDIX A

GEBOD Body Description Tabular Output (GEBOD.TAB)

01/10/90
ADULT HUMAN MALE
SELECTED BODY DIMENSIONS

WEIGHT 75.00 %-TILE

COMPUTED BODY DIMENSIONS

0	WEIGHT	188.0	LB.
1	STANDING HEIGHT	70.66	IN.
2	SHOULDER HEIGHT	58.01	IN.
3	ARMPIT HEIGHT	51.78	IN.
4	WAIST HEIGHT	42.44	IN.
5	SEATED HEIGHT	37.07	IN.
6	HEAD LENGTH	7.869	IN.
7	HEAD BREADTH	6.186	IN.
8	HEAD TO CHIN HEIGHT	9.011	IN.
9	NECK CIRCUMFERENCE	15.44	IN.
10	SHOULDER BREADTH	16.27	IN.
11	CHEST DEPTH	10.04	IN.
12	CHEST BREADTH	13.33	IN.
13	WAIST DEPTH	9.216	IN.
14	WAIST BREADTH	12.73	IN.
15	BUTTOCK DEPTH	9.879	IN.
16	HIP BREADTH,STANDING	14.29	IN.
17	SHOULDER TO ELBOW LENGTH	14.33	IN.
18	FOREARM-HAND LENGTH	19.68	IN.
19	BICEPS CIRCUMFERENCE	12.89	IN.
20	ELBOW CIRCUMFERENCE	12.57	IN.
21	FOREARM CIRCUMFERENCE	11.39	IN.
22	WRIST CIRCUMFERENCE	7.067	IN.
23	KNEE HEIGHT,SEATED	22.31	IN.
24	THIGH CIRCUMFERENCE	24.16	IN.
25	UPPER LEG CIRCUMFERENCE	15.69	IN.
26	KNEE CIRCUMFERENCE	15.95	IN.
27	CALF CIRCUMFERENCE	15.11	IN.
28	ANKLE CIRCUMFERENCE	9.054	IN.
29	ANKLE HEIGHT,OUTSIDE	5.462	IN.
30	FOOT BREADTH	3.904	IN.
31	FOOT LENGTH	10.79	IN.

WEIGHT CORRECTION FACTOR = 1.099

01/10/90

CRASH VICTIM PARAMETERS (3-D)

SEGMENT NO.	SYM	PLOT	WEIGHT (LB.)	SEGMENT MOMENT OF INERTIA (LB-SEC**2-IN) X	Y	Z	SEGMENT CONTACT ELLIPSOID SEMIAXIS (IN) X	Y	Z	CENTER (IN) X	Y	Z
1	LT	1	31.18	1.34822	0.83419	1.47922	4.94	7.14	3.65	0.00	0.00	-0.07
2	CT	2	11.63	0.33664	0.18749	0.47497	4.61	6.36	4.01	0.00	0.00	-0.01
3	UT	3	48.11	2.84603	2.29042	1.94681	5.02	6.66	7.01	0.00	0.00	-0.83
4	N	4	3.06	0.02435	0.02435	0.01918	2.46	2.46	3.05	0.00	0.00	0.00
5	H	5	11.61	0.25522	0.79078	0.15060	3.93	3.09	5.73	0.00	0.00	0.00
6	RUL	6	20.12	1.61197	1.61197	0.20966	3.17	3.17	12.03	0.00	0.00	0.00
7	RLL	7	8.80	0.40723	0.40723	0.05271	2.41	2.41	9.14	0.00	0.00	0.00
8	RF	8	1.89	0.03583	0.03461	0.00470	2.73	1.95	5.40	0.00	0.00	1.40
9	LUL	9	20.12	1.61197	1.61197	0.20966	3.17	3.17	12.03	0.00	0.00	0.00
10	LLL	A	8.80	0.40723	0.40723	0.05271	2.41	2.41	9.14	0.00	0.00	0.00
11	LF	B	1.89	0.03583	0.03461	0.00470	2.73	1.95	5.40	0.00	0.00	1.40
12	RUA	C	5.01	0.14425	0.14425	0.02185	2.05	2.05	7.17	0.00	0.00	0.00
13	RLA	D	5.38	0.27386	0.27886	0.01830	1.81	1.81	9.84	0.00	0.00	0.00
14	LUA	E	5.01	0.14425	0.14425	0.02185	2.05	2.05	7.17	0.00	0.00	0.00
15	LLA	F	5.38	0.27886	0.27886	0.01830	1.81	1.81	9.84	0.00	0.00	0.00

JOINT J	SYM	PLOT	JNT	PIN	LOCATION(IN) - SEG(JNT) X	Y	Z	LOCATION(IN) - SEG(J+1) X	Y	Z	PRIN. AXIS(DEG) - SEG(JNT) YAW	PITCH	ROLL	PRIN. AXIS(DEG) - SEG(J+1) YAW	PITCH	ROLL
1	P	M	1	0	0.00	0.00	-3.72	0.00	0.00	1.55	0.00	0.00	0.00	0.00	0.00	0.00
2	W	N	2	0	0.00	0.00	-1.57	0.00	0.00	6.18	0.00	0.00	0.00	0.00	0.00	0.00
3	NP	O	3	0	0.00	0.00	-7.83	0.00	0.00	0.59	0.00	0.00	0.00	0.00	20.00	0.00
4	HP	P	4	0	0.00	0.00	-0.59	0.00	0.00	5.73	0.00	0.00	0.00	0.00	0.00	0.00
5	RH	Q	1	0	0.00	3.30	-0.27	0.00	0.00	-8.18	0.00	0.00	0.00	8.10	-44.40	14.50
6	RK	R	6	1	0.00	0.00	9.49	0.00	0.00	-6.60	0.00	0.00	0.00	0.00	65.60	-3.30
7	RA	S	7	0	0.00	0.00	7.70	2.73	0.00	-2.55	0.00	0.00	0.00	-8.10	-80.00	0.00
8	LH	T	1	0	0.00	-3.30	-0.27	0.00	0.00	-8.18	0.00	0.00	0.00	-8.10	-44.40	-14.50
9	LK	U	9	1	0.00	0.00	9.49	0.00	0.00	-6.60	0.00	0.00	0.00	0.00	65.60	3.30
10	LA	V	10	0	0.00	0.00	7.70	2.73	0.00	-2.55	0.00	0.00	0.00	8.10	-80.00	0.00
11	RS	W	3	0	0.00	6.08	-5.00	0.00	0.00	-5.11	0.00	0.00	0.00	28.80	-39.60	63.30
12	RE	X	12	1	0.00	0.00	5.16	0.00	0.00	-7.84	0.00	0.00	0.00	80.00	-70.00	0.00
13	LS	Y	3	0	0.00	-6.08	-5.00	0.00	0.00	-5.11	0.00	0.00	0.00	-28.80	-39.60	-63.30
14	LE	Z	14	1	0.00	0.00	5.16	0.00	0.00	-7.84	0.00	0.00	0.00	-80.00	-70.00	0.00

JOINTS RA, LA, RE, & LE ARE ORDERED PITCH, YAW, ROLL

APPENDIX B

GEBOD Body Description File Output (GEBOD.AIN)

```
   15    14        01/10/90                                            CARD B.1
LT   1 31.181.34820.83421.4792 4.940 7.144 3.645 0.000 0.000-0.072     CARD B.2
CT   2 11.630.33660.18750.4750 4.608 6.363 4.015 0.000 0.000-0.010     CARD B.2
UT   3 48.112.84602.29041.9468 5.020 6.663 7.006 0.000 0.000-0.826     CARD B.2
N    4  3.060.02430.02430.0192 2.458 2.458 3.049 0.000 0.000 0.000     CARD B.2
H    5 11.610.25520.29080.1506 3.935 3.093 5.734 0.000 0.000 0.000     CARD B.2
RUL 6 20.121.61201.61200.2097 3.172 3.17212.026 0.000 0.000 0.000      CARD B.2
RLL 7  8.800.40720.40720.0527 2.405 2.405 9.143 0.000 0.000 0.000      CARD B.2
RF  8  1.890.03580.03460.0047 2.731 1.952 5.395 0.000 0.000 1.401      CARD B.2
LUL 9 20.121.61201.61200.2097 3.172 3.17212.026 0.000 0.000 0.000      CARD B.2
LLL A  8.800.40720.40720.0527 2.405 2.405 9.143 0.000 0.000 0.000      CARD B.2
LF  B  1.890.03580.03460.0047 2.731 1.952 5.395 0.000 0.000 1.401      CARD B.2
RUA C  5.010.14420.14420.0218 2.051 2.051 7.166 0.000 0.000 0.000      CARD B.2
RLA D  5.380.27890.27890.0183 1.813 1.813 9.841 0.000 0.000 0.000      CARD B.2
LUA E  5.010.14420.14420.0218 2.051 2.051 7.166 0.000 0.000 0.000      CARD B.2
LLA F  5.380.27890.27890.0183 1.813 1.813 9.841 0.000 0.000 0.000      CARD B.2
 P  M    1    0  0.00  0.00 -3.72  0.00  0.00  1.55                   CARD B.3
                 0.00  0.00  0.00  0.00  0.00  0.00                       0 0 0
 W  N    2    0  0.00  0.00 -1.57  0.00  0.00  6.18                   CARD B.3
                 0.00  0.00  0.00  0.00  0.00  0.00                       0 0 0
 NP O    3    0  0.00  0.00 -7.83  0.00  0.00  0.59                   CARD B.3
                 0.00  0.00  0.00  0.00 20.00  0.00                       0 0 0
 HP P    4    0  0.00  0.00 -0.59  0.00  0.00  5.73                   CARD B.3
                 0.00  0.00  0.00  0.00  0.00  0.00                       0 0 0
 RH Q    1    0  0.00  3.30 -0.27  0.00  0.00 -8.18                   CARD B.3
                 0.00  0.00  0.00  8.10-44.40 14.50                       0 0 0
 RK R    6    1  0.00  0.00  9.49  0.00  0.00 -6.60                   CARD B.3
                 0.00  0.00  0.00  0.00 65.60 -3.30                       0 0 0
 RA S    7    0  0.00  0.00  7.70  2.73  0.00 -2.55                   CARD B.3
                 0.00  0.00  0.00 -8.10-80.00  0.00                       2 3 1
 LH T    1    0  0.00 -3.30 -0.27  0.00  0.00 -8.18                   CARD B.3
                 0.00  0.00  0.00 -8.10-44.40-14.50                       0 0 0
 LK U    9    1  0.00  0.00  9.49  0.00  0.00 -6.60                   CARD B.3
                 0.00  0.00  0.00  0.00 65.60  3.30                       0 0 0
 LA V   10    0  0.00  0.00  7.70  2.73  0.00 -2.55                   CARD B.3
                 0.00  0.00  0.00  8.10-80.00  0.00                       2 3 1
 RS W    3    0  0.00  6.08 -5.00  0.00  0.00 -5.11                   CARD B.3
                 0.00  0.00  0.00 28.80-39.60 63.30                       0 0 0
 RE X   12    1  0.00  0.00  5.16  0.00  0.00 -7.84                   CARD B.3
                 0.00  0.00  0.00 80.00-70.00  0.00                       2 3 1
 LS Y    3    0  0.00 -6.08 -5.00  0.00  0.00 -5.11                   CARD B.3
                 0.00  0.00  0.00-28.80-39.60-63.30                       0 0 0
 LE Z   14    1  0.00  0.00  5.16  0.00  0.00 -7.84                   CARD B.3
                 0.00  0.00  0.00-80.00-70.00  0.00                       2 3 1
```

APPENDIX C1

Example 1, ATB Basic Sled Test Simulation Input File (EX1.AIN)

```
2 SEPT 1988    0   0    0.0                                                        CARD A1A
EXAMPLE 1:  BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
 IN. LB.SEC.          0.0          0.0       386.088          0.0                  CARD A3
   4  40    0.002  0.0005    0.001.0000625                                         CARD A4
 1 040 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1CARD A5
   15    14          95TH PERCENTILE MALE                                          CARD B1
 LT  134.7721.62801.01011.7954 5.168 7.436 3.778 0.000 0.000-0.072   0  CARD B2A
 CT  213.0990.41600.23010.5857 4.809 6.673 4.145 0.000 0.000-0.011   0  CARD B2A
 UT  353.6733.45252.78322.3509 5.220 6.906 7.314 0.000 0.000-0.872   0  CARD B2A
 N   4 3.2890.02780.02780.0216 2.520 2.520 3.156 0.000 0.000 0.000   0  CARD B2A
 H   511.9270.27080.30850.1584 3.984 3.125 5.836 0.000 0.000 0.000   0  CARD B2A
 RUL 622.7252.01302.01300.2576 3.308 3.30812.652 0.000 0.000 0.000   0  CARD B2A
 RLL 7 9.7630.49890.49890.0626 2.487 2.487 9.616 0.000 0.000 0.000   0  CARD B2A
 RF  8 2.0790.04260.04120.0055 2.866 2.016 5.617 0.000 0.000 1.462   0  CARD B2A
 LUL 922.7252.01302.01300.2576 3.308 3.30812.652 0.000 0.000 0.000   0  CARD B2A
 LLL A 9.7630.49890.49890.0626 2.487 2.487 9.616 0.000 0.000 0.000   0  CARD B2A
 LF  B 2.0790.04260.04120.0055 2.866 2.016 5.617 0.000 0.000 1.462   0  CARD B2A
 RUA C 5.5420.17430.17430.0259 2.122 2.122 7.497 0.000 0.000 0.000   0  CARD B2A
 RLA D 5.9010.33310.33310.0214 1.871 1.87110.269 0.000 0.000 0.000   0  CARD B2A
 LUA E 5.5420.17430.17430.0259 2.122 2.122 7.497 0.000 0.000 0.000   0  CARD B2A
 LLA F 5.9010.33310.33310.0214 1.871 1.87110.269 0.000 0.000 0.000   0  CARD B2A
  P  M    1    0  0.00   0.00 -3.85   0.00   0.00   1.61                      CARD B3A
                  0.00   0.00  0.00   0.00   5.00   0.00
  W  N    2    0  0.00   0.00 -1.64   0.00   0.00   6.44                      CARD B3A
                  0.00   0.00  0.00   0.00   5.00   0.00
  NP O    3    0  0.00   0.00 -8.19   0.00   0.00   0.64                      CARD B3A
                  0.00   0.00  0.00   0.00  10.00   0.00
  HP P    4    0  0.00   0.00 -0.64   0.00   0.00   5.84                      CARD B3A
                  0.00   0.00  0.00   0.00  10.00   0.00
  RH Q    1    0  0.00   3.42 -0.31   0.00   0.00  -8.64                      CARD B3A
                  0.00   0.00  0.00   0.00 -45.00   0.00
  RK R    6    1  0.00   0.00 10.00   0.00   0.00  -6.97                      CARD B3A
                  0.00   0.00  0.00   0.00  60.00   0.00
  RA S    7    0  0.00   0.00  8.12   2.87   0.00  -2.66                      CARD B3A
                  0.00  90.00  0.00   0.00  10.00   0.00
  LH T    1    0  0.00  -3.42 -0.31   0.00   0.00  -8.64                      CARD B3A
                  0.00   0.00  0.00   0.00 -45.00   0.00
  LK U    9    1  0.00   0.00 10.00   0.00   0.00  -6.97                      CARD B3A
                  0.00   0.00  0.00   0.00  60.00   0.00
  LA V   10    0  0.00   0.00  8.12   2.87   0.00  -2.66                      CARD B3A
                  0.00  90.00  0.00   0.00  10.00   0.00
  RS W    3    0  0.00   6.24 -5.22   0.00   0.00  -5.37                      CARD B3A
                  0.00   0.00  0.00   0.00  -4.10   0.00
  RE X   12    1  0.00   0.00  5.42   0.00   0.00  -8.20                      CARD B3A
                  0.00   0.00  0.00   0.00 -70.00   0.00
  LS Y    3    0  0.00  -6.24 -5.22   0.00   0.00  -5.37                      CARD B3A
                  0.00   0.00  0.00   0.00  -4.10   0.00
  LE Z   14    1  0.00   0.00  5.42   0.00   0.00  -8.20                      CARD B3A
                  0.00   0.00  0.00   0.00 -70.00   0.00
  .000 10.00    .00  0.70      20.000  .000 10.00   .00  0.70      5.000CARD B4
  .000 10.00    .00  0.70      20.000  .000 10.00   .00  0.70     35.000CARD B4
  .000  5.00    .00  0.70      25.000  .000 10.00   .00  0.70     35.00 CARD B4
  .000  5.00    .00  0.70      25.000  .000 10.00   .00  0.70     35.00 CARD B4
  .000 10.00    .00  0.70      70.000  .000  .800   .00  0.70     40.00 CARD B4
  .000  1.80    .00  0.70      60.000  .000  .000   .00   .00       .00 CARD B4
  .000  7.00    .00  0.70      35.000  .000 10.00   .00  0.70     26.00 CARD B4
  .000 10.00    .00  0.70      70.000  .000  .800   .00  0.70     40.000CARD B4
  .000  1.80    .00  0.70      60.000  .000  .000   .00   .00       .00 CARD B4
  .000  7.00    .00  0.70      35.000  .000 10.00   .00  0.70     26.00 CARD B4
  .000 10.00    .00  0.70     122.500  .000 10.00   .00  0.70     65.00 CARD B4
  .000  1.80    .00  0.70      70.000  .000   .00   .00   .00       .00 CARD B4
  .000 10.00    .00  0.70     122.500  .000 10.00   .00  0.70     65.00 CARD B4
  .000  1.80    .00  0.70      70.000  .000   .00   .00   .00       .00 CARD B4
   0.1    0.0  30.0    0.0    0.0                   0.0    0.0              CARD B5
   0.1    0.0  30.0    0.0    0.0                   0.0    0.0              CARD B5
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    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    0.1   0.0  30.0   0.0   0.0                          0.0   0.0              CARD B5
    .01   .01   .01   .01   .01   .01   .10   .10   .10   .10   .10  .01CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
    .01   .01   .01   .00   .00   .00   .10   .10   .10   .00   .00  .00CARD B6
SLED ACCELERATION - 20G PEAK
    0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0    15   0.0 0.010    0CARD C2A
    0.0   5.0  10.0  15.0  20.0  15.0  10.0   5.0   0.0   0.0   0.0  0.0CARD C3
    0.0   0.0   0.0                                                     CARD C3
     12     0     0     3     0     0     1     0     0     0           CARD D1
    1    SEAT. 6 DEGREE OFF HORIZONTAL.                                 CARD D2A
         10.0          8.0        -10.0                                 CARD D2B
        28.01          8.0        -11.89                                CARD D2C
         10.0         -8.0        -10.0                                 CARD D2D
    2    BACK PANEL.  13 DEGREE OFF VERTICAL.                           CARD D2A
          1.0          9.0        -48.97                                CARD D2B
         10.0          9.0        -10.0                                 CARD D2C
          1.0         -9.0        -48.97                                CARD D2D
    3    FLOOR.                                                         CARD D2A
          0.0         12.0          -1.3                                CARD D2B
         60.0         12.0          -1.3                                CARD D2C
          0.0        -12.0          -1.3                                CARD D2D
    4    HEAD PAD. 13 DEGR                                              CARD D2A
         2.48          7.5        -47.26                                CARD D2B
         4.96          7.5        -36.55                                CARD D2C
         2.48         -7.5        -47.26                                CARD D2D
    5    SEAT FRONT PANEL.                                              CARD D2A
        28.01          8.0        -11.89                                CARD D2B
        26.66          8.0         -4.40                                CARD D2C
        28.01         -8.0        -11.89                                CARD D2D
    6    BACK PANEL2. 13 DEGREE OFF VERTICAL.                           CARD D2A
          1.0          9.0        -48.97                                CARD D2B
         10.0          9.0        -10.0                                 CARD D2C
          1.0         -9.0        -48.97                                CARD D2D
    7    FIREWALL.                                                      CARD D2A
         60.0         12.0         -25.0                                CARD D2B
         60.0        -12.0         -25.0                                CARD D2C
         60.0         12.0         -0.75                                CARD D2D
    8    RIGHT SIDE SEAT/IN.                                            CARD D2A
         8.41          8.1         -6.66                                CARD D2B
         8.70          8.1        -14.73                                CARD D2C
        30.58          8.1         -6.64                                CARD D2D
    9    LEFT SIDE SEAT/IN.                                             CARD D2A
         8.41         -8.1         -6.66                                CARD D2B
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       30.58        -8.1        -6.64                                                  CARD D2C
        8.70        -8.1       -14.73                                                  CARD D2D
 10     RUDDER PEDALS.                                                                 CARD D2A
      49.992         9.0   -2.239222                                                   CARD D2B
      52.992         9.0  -4.7565222                                                   CARD D2C
      49.992        -9.0   -2.239222                                                   CARD D2D
 11     LEFT SIDE PANEL.                                                               CARD D2A
         1.0        -9.0       -48.97                                                  CARD D2B
        10.9        -9.0        -6.10                                                  CARD D2C
       -7.77        -9.0       -46.95                                                  CARD D2D
 12     RIGHT SIDE PANEL.                                                              CARD D2A
         1.0         9.0       -48.97                                                  CARD D2B
       -7.77         9.0       -46.95                                                  CARD D2C
        10.9         9.0        -6.10                                                  CARD D2D
   22    4.5   3.0   3.0   0.0   4.0  -3.5   0.0   0.0   0.0                           CARD D5
   23    3.2   6.0   8.0   0.0   0.0  -7.0   0.0   0.0   0.0                           CARD D5
   24    6.0  15.0   5.0  38.0   0.0 -28.0   0.0   0.0   0.0 20.  20.  20.CARD D5
 0   0   0   0   0   0   0   0   0   0   0   0   0   0   0                             CARD D7
 3      SEGMENT-SEGMENT FCN.                                                           CARD E1
         0.0        -5.0         0.0         0.0         1.0                           CARD E2
   6                                                                                   CARD E4A
         0.0         0.0         1.0       470.0         2.0       890.0CARD E4B
         3.0      1220.0         4.0      1470.0         5.0      1580.0CARD E4B
 6      CONSTANT, F=0.0                                                                CARD E1
         0.0         0.0         0.0         0.0         0.0                           CARD E2
 7      R FACTOR.                                                                      CARD E1
         0.0         0.0         0.7         0.0         0.0                           CARD E2
 13     STIFF SURFACES                                                                 CARD E1
         0.0        -4.0         0.0         0.0         1.0                           CARD E2
   8                                                                                   CARD E4A
         0.0         0.0         0.1         5.0         0.2        20.0CARD E4B
         0.3        40.0         0.4        60.0         1.0       860.0CARD E4B
         2.0      2400.0         3.0      4000.0                                       CARD E4B
 14     FRICTION FUNC.                                                                 CARD E1
         0.0         0.0         0.5         0.0         1.0                           CARD E2
 19     CF=.25,CREST=.25                                                               CARD E1
         0.0         0.0        0.25         0.0         0.0                           CARD E2
 20     DAMPING COEFF. C=900                                                           CARD E1
         0.0        1.00         0.0         0.0         1.0                           CARD E2
         0.0       900.0         0.0         0.0         0.0         0.0CARD E3
 21     RATE OF DEFLEC.                                                                CARD E1
       -40.0     -150.00         0.0         0.0         1.0                           CARD E2
  21                                                                                   CARD E4A
       -40.0       0.000       -30.0       0.000       -20.0       0.000CARD E4B
       -10.0       0.000         0.0       0.000         5.0       1.000CARD E4B
        10.0       1.000        20.0       0.990        30.0       0.965CARD E4B
        40.0       0.928        50.0       0.860        60.0       0.690CARD E4B
        70.0       0.475        80.0       0.340        90.0       0.260CARD E4B
       100.0       0.200       110.0       0.180       120.0       0.090CARD E4B
       130.0       0.060       140.0       0.025       150.0       0.000CARD E4B
 22     DAMPING COEFF. C=35                                                            CARD E1
         0.0        1.00         0.0         0.0         1.0                           CARD E2
         0.0        35.0         0.0         0.0         0.0         0.0CARD E3
 24     DAMPING COEFF. C=0.8                                                           CARD E1
     -1000.0     -1000.0         0.0         0.0         1.0                           CARD E2
   4                                                                                   CARD E4A
     -1000.0         0.6        -1.0         0.6         0.0         1.0CARD E4B
      1000.0         1.0                                                               CARD E4B
 25     DAMPING COEFF C=1100                                                           CARD E1
         0.0        1.00         0.0         0.0         1.0                           CARD E2
         0.0      1100.0         0.0         0.0         0.0         0.0CARD E3
 26     STIFF SURFACES-LL                                                              CARD E1
         0.0        -4.0         0.0         0.0         1.0                           CARD E2
   8                                                                                   CARD E4A
         0.0         0.0         0.1         5.0         0.2        20.0CARD E4B
         0.3        40.0         0.4        60.0         2.0       860.0CARD E4B
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         3.0       2400.0          4.0       4000.0                        CARD E4B
  31    HARNESS FDF                                                        CARD E1
         0.0         -4.0          0.0          0.0          0.0       0.0CARD E2
    8                                                                      CARD E4A
         0.0          0.0         0.01        150.0         0.02     300.0CARD E4B
        0.03        450.0         0.05        850.0         0.10    3500.0CARD E4B
        1.00      35000.0         4.00     140000.0                        CARD E4B
  32    HARNESS FRICTION                                                   CARD E1
         0.0          0.0          0.2          0.0          0.2           CARD E2
  34    HARNESS FRICTION                                                   CARD E1
         0.0          0.0          0.9          0.0          0.2           CARD E2
9999                                                                       CARD E1
   3   3   2   1   0   0   0   0   0   2   0   0                           CARD F1A
   1  16   1   1  13 -20 -21   0  14   1                                   CARD F1B
   1  16   6   6  13 -25 -21   0  14   1                                   CARD F1B
   1  16   9   9  13 -25 -21   0  14   1                                   CARD F1B
   2  16   1   1  13 -20 -21   0  14   1                                   CARD F1B
   2  16   2   2  13 -20 -21   0  14   1                                   CARD F1B
   2  16   3   3  13 -20 -21   0  14   1                                   CARD F1B
   3  16   8   8  13 -22 -21   0  14  -1                                   CARD F1B
   3  16  11  11  13 -22 -21   0  14  -1                                   CARD F1B
   4  16   5   5  13 -22 -21   0  14   1                                   CARD F1B
  10  16   8   8  13 -22 -21   0  14   1                                   CARD F1B
  10  16  11  11  13 -22 -21   0  14   1                                   CARD F1B
   0   2   0   0   0   1   0   0   1   0   0   0   1   0   1               CARD F3A
   2   2  13  13   3   0   7   0  19                                       CARD F3B
   2   2  15  15   3   0   7   0  19                                       CARD F3B
   6   6  13  13   3   0   7   0  19                                       CARD F3B
   9   9  15  15   3   0   7   0  19                                       CARD F3B
  13  13  16  24  13 -22 -21   0  14                                       CARD F3B
  15  15  16  24  13 -22 -21   0  14                                       CARD F3B
   0   0   0   0   0   0   0   0   0   0   0   0   0   0                   CARD F4A
   2                                                                       CARD F8A
  12  15                                                                   CARD F8B
  31   0   0   0   0         0.0                                           CARD F8C
  16   0   1   1   0   0   0   0   0       13.000          8.0   -10.300CRD F8D1
                                              2.4         22.0      -0.3CRD F8D2
   1   1   0   1   0   0   0   0  34       -1.178        7.075    -0.781CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34       -0.029        6.796    -1.534CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34        0.910        5.778    -2.283CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34        2.228        2.355    -3.192CRD F8D1
                                                                         CRD F8D2
   1  23   0   1   0   0   0   0   0        2.957         0.00     3.059CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34         3.07         -.08     -4.41CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34        1.785       -2.325    -3.343CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34        0.011       -5.145    -2.728CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34       -0.880       -5.789    -2.282CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  34       -2.460       -6.099    -1.200CRD F8D1
                                                                         CRD F8D2
  16   0   1   1   0   0   0   0   0       13.000         -8.0   -10.300CRD F8D1
                                              2.4         22.0      -0.3CRD F8D2
  31   0   0   0   0         0.0                                         CARD F8C
  16   0   1   1   0   0   0   0   0       13.000         -8.0   -10.300CRD F8D1
                                              0.7         17.5     -21.3CRD F8D2
   1   1   0   1   0   0   0   0  32       -2.445       -6.101    -1.213CRD F8D1
                                                                         CRD F8D2
   1   1   0   1   0   0   0   0  32        -0.96         -6.0     -2.50CRD F8D1
                                                                         CRD F8D2
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  1  23   0   1   0   0   0   0   0        0.00         -5.7          3.80CRD F8D1
                                                                           CRD F8D2
  1   1   0   1   0   0   0   0  32        0.01         -4.0         -4.50CRD F8D1
                                                                           CRD F8D2
  2   2   0   1   0   0   0   0  32        1.818        -5.439       -1.820CRD F8D1
                                                                           CRD F8D2
  2   2   0   1   0   0   0   0  32        2.50         -2.5         -1.50CRD F8D1
                                                                           CRD F8D2
  3   3   0   1   0   0   0   0  32        3.00         -1.5          6.50CRD F8D1
                                                                           CRD F8D2
  3   3   0   1   0   0   0   0  32        4.487        -0.133        3.734CRD F8D1
                                                                           CRD F8D2
  3   3   0   1   0   0   0   0  32        4.421         3.319       -1.662CRD F8D1
                                                                           CRD F8D2
  3   3   0   1   0   0   0   0  32        0.879         4.202       -5.672CRD F8D1
                                                                           CRD F8D2
  3  22   0   0   0   0   0   0  32        0.30          0.2         -2.80CRD F8D1
                                                                           CRD F8D2
  3   3   0   1   0   0   0   0  32       -1.00          4.3         -6.00CRD F8D1
                                                                           CRD F8D2
  3   3   0   1   0   0   0   0  32       -2.50          4.3         -4.00CRD F8D1
                                                                           CRD F8D2
 16   0   1   1   0   0   0   0   0        0.000         5.00       -35.200CRD F8D1
                                             0.7        17.5         -21.3CRD F8D2
      0.0       0.0       0.0   0   0   0   0   0                           CARD G1A
  14.3810       0.0  -13.7500       0.0       0.0       0.0                 CARD G2
      0.0     12.90       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     12.95       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     13.28       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     13.46       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     13.46       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0    92.900       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0    48.650       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0    128.80       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0    92.900       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0    48.650       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0    128.80       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     24.50       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     85.00       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     24.50       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
      0.0     85.00       0.0       0.0       0.0       0.0   3   2   1    0CARD G3A
    3     3          0.0         0.0         0.0                            CARD H1A
        1 -5         0.0         0.0         0.0                            CARD H1B
       16  5         0.0         0.0         0.0                            CARD H1B
    3     3          0.0         0.0         0.0                            CARD H2A
           5         0.0         0.0         0.0                            CARD H2B
        3  5         0.0         0.0         0.0                            CARD H2B
    3     3          0.0         0.0         0.0                            CARD H3A
           5         0.0         0.0         0.0                            CARD H3B
        3  5         0.0         0.0         0.0                            CARD H3B
    3     3     5 16   5                                                    CARD H4
    3     3     5  5   5                                                    CARD H5
    3     3     5  3   5                                                    CARD H6
    2     3     4                                                           CARD H7
    0                                                                       CARD H8
    1   5   4                                                               CARD H9
    1                                                                       CRD H10A
 16 15  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15                         CRD H10B
  2   1                                                                     CARD H11
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APPENDIX C2

Example 1, ATB Basic Sled Test Simulation
386 Directory File (ATBIV1.DIR)

EXP1.TP1	UNIT 1	ATB OUTPUT, VIEW BODY ELEMENT AND CONTACT PLANE INPUT	
EXP1.PRP	UNIT 2	ATB PRINTER PLOTS	
ATB.ROU	UNIT 3	ATB RESTART RUN OUTPUT FILE	
ATB.RIN	UNIT 4	ATB RESTART RUN INPUT FILE	
EX1.AIN	UNIT 5	ATB INPUT, GEBOD BODY DESCRIPTION OUTPUT	
EXP1.AOU	UNIT 6	ATB PRIMARY OUTPUT FILE	
EXP1.TP8	UNIT 8	ATB SUBROUTINE POSTPR OUTPUT FILE	
0 IDEF	UNIT 10	DRAWING OPTION	SEE PLOTWORKS, PLOT88, 3.1
91 IOPORT	UNIT 10	HARDWARE INTERFACE 91/ 1	SEE PLOTWORKS, PLOT88, 3.1
91 MODEL	UNIT 10	OUTPUT DEVICE 91/64	SEE PLOTWORKS, PLOT88, 3.1
EXP1.T24	21 - 85	LAST ATB TABULAR TIME HISTORY OUTPUT FILE (21-85)	

APPENDIX C3

Example 1, ATB Basic Sled Test Simulation
386 Output File (EXP1.AOU)

DEVELOPED BY CALSPAN CORP., P.O. BOX 400, BUFFALO NY 14225
AND BY J&J TECHNOLOGIES INC., ORCHARD PARK, NY 14127

FOR THE AIR FORCE ARMSTRONG AEROSPACE MEDICAL RESEARCH
LABORATORY, WRIGHT PATTERSON AIR FORCE BASE
UNDER CONTRACTS F33615-75C-5002,-78C-0516 AND -80C-05117

AND FOR THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION,
U.S. DEPARTMENT OF TRANSPORTATION, UNDER CONTRACTS
FH-11-7592, HS-053-2-485, HS-6-01300 AND HS-6-01410.

PROGRAM DOCUMENTATION: NHTSA REPORT NOS. DOT-HS-801-507
THROUGH 510 (FORMERLY CALSPAN REPORT NO. ZQ-5180-L-1),
AVAILABLE FROM NTIS (ACCESSION NOS. PB-241692,3,4 AND 5),
APPENDIXES A-J TO THE ABOVE (AVAILABLE FROM CALSPAN),
AND REPORT NOS. AMRL-TR-75-14 (NTIS NO. AD-A014 816),
AFAMRL-TR-80-14 (NTIS NO. AD-A088 029), AND
AFAMRL-TR-83-073 (NTIS NO. AD-B079 184).

PROGRAM ATB-IV 80386 IMPLEMENTATION COMPLETED BY KETRON,
OCTOBER 31, 1989, UNDER CONTRACT F33615-88-C-0543

2 SEPT 1988 IRSIN= 0 IRSOUT= 0 RSTIME = 0.0000 CARDS A

EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

UNITL = IN. UNITM = LB. UNITT = SEC. GRAVITY VECTOR = (0.0000, 0.0000, 386.0880) G = 386.0880

NDINT = 4 NSTEPS = 40 DT =0.002000 HO =0.000500 HMAX =0.001000 HMIN =0.000063

NPRT ARRAY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	0	40	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

CARD B.1
CARDS B.2

SEGMENT			WEIGHT	PRINCIPAL MOMENTS OF INERTIA (LB.-SEC.**2- IN.)			SEGMENT CONTACT ELLIPSOID SEMIAXES (IN.)			CENTER (IN.)			PRINCIPAL AXES (DEG)		
I	SYM	PLOT	(LB.)	X	Y	Z	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL
1	LT	1	34.772	1.6280	1.0101	1.7954	5.168	7.436	3.778	0.000	0.000	-0.072	0.00	0.00	0.00
2	CT	2	13.099	0.4160	0.2301	0.5857	4.809	6.673	4.145	0.000	0.000	-0.011	0.00	0.00	0.00
3	UT	3	53.673	3.4525	2.7832	2.3509	5.220	6.906	7.314	0.000	0.000	-0.872	0.00	0.00	0.00
4	N	4	3.289	0.0278	0.0278	0.0216	2.520	2.520	3.156	0.000	0.000	0.000	0.00	0.00	0.00
5	H	5	11.927	0.2708	0.3085	0.1584	3.984	3.125	5.836	0.000	0.000	0.000	0.00	0.00	0.00
6	RUL	6	22.725	2.0130	2.0130	0.2576	3.308	3.308	12.652	0.000	0.000	0.000	0.00	0.00	0.00
7	RLL	7	9.763	0.4989	0.4989	0.0626	2.487	2.487	9.616	0.000	0.000	0.000	0.00	0.00	0.00
8	RF	8	2.079	0.0426	0.0412	0.0055	2.866	2.016	5.617	0.000	0.000	1.462	0.00	0.00	0.00
9	LUL	9	22.725	2.0130	2.0130	0.2576	3.308	3.308	12.652	0.000	0.000	0.000	0.00	0.00	0.00
10	LLL	A	9.763	0.4989	0.4989	0.0626	2.487	2.487	9.616	0.000	0.000	0.000	0.00	0.00	0.00
11	LF	B	2.079	0.0426	0.0412	0.0055	2.866	2.016	5.617	0.000	0.000	1.462	0.00	0.00	0.00
12	RUA	C	5.542	0.1743	0.1743	0.0259	2.122	2.122	7.497	0.000	0.000	0.000	0.00	0.00	0.00
13	RLA	D	5.901	0.3331	0.3331	0.0214	1.871	1.871	10.269	0.000	0.000	0.000	0.00	0.00	0.00
14	LUA	E	5.542	0.1743	0.1743	0.0259	2.122	2.122	7.497	0.000	0.000	0.000	0.00	0.00	0.00
15	LLA	F	5.901	0.3331	0.3331	0.0214	1.871	1.871	10.269	0.000	0.000	0.000	0.00	0.00	0.00

CARDS B.3

JOINT					LOCATION(IN.) - SEG(JNT)			LOCATION(IN.) - SEG(J+1)			PRIN. AXIS(DEG) - SEG(JNT)			PRIN. AXIS(DEG) - SEG(J+1)		
J	SYM	PLOT	JNT	PIN	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL	YAW	PITCH	ROLL
1	P	M	1	0	0.000	0.000	-3.850	0.000	0.000	1.610	0.00	0.00	0.00	0.00	5.00	0.00
2	W	N	2	0	0.000	0.000	-1.640	0.000	0.000	6.440	0.00	0.00	0.00	0.00	5.00	0.00
3	NP	O	3	0	0.000	0.000	-8.190	0.000	0.000	0.640	0.00	0.00	0.00	0.00	10.00	0.00
4	HP	P	4	0	0.000	0.000	-0.640	0.000	0.000	5.840	0.00	0.00	0.00	0.00	10.00	0.00
5	RH	Q	1	0	0.000	3.420	-0.310	0.000	0.000	-8.640	0.00	0.00	0.00	0.00	-45.00	0.00
6	RK	R	6	1	0.000	0.000	10.000	0.000	0.000	-6.970	0.00	0.00	0.00	0.00	60.00	0.00
7	RA	S	7	0	0.000	0.000	8.120	2.870	0.000	-2.660	0.00	90.00	0.00	0.00	10.00	0.00
8	LH	T	1	0	0.000	-3.420	-0.310	0.000	0.000	-8.640	0.00	0.00	0.00	0.00	-45.00	0.00
9	LK	U	9	1	0.000	0.000	10.000	0.000	0.000	-6.970	0.00	0.00	0.00	0.00	60.00	0.00
10	LA	V	10	0	0.000	0.000	8.120	2.870	0.000	-2.660	0.00	90.00	0.00	0.00	10.00	0.00
11	RS	W	3	0	0.000	6.240	-5.220	0.000	0.000	-5.370	0.00	0.00	0.00	0.00	-4.10	0.00
12	RE	X	12	1	0.000	0.000	5.420	0.000	0.000	-8.200	0.00	0.00	0.00	0.00	-70.00	0.00
13	LS	Y	3	0	0.000	-6.240	-5.220	0.000	0.000	-5.370	0.00	0.00	0.00	0.00	-4.10	0.00
14	LE	Z	14	1	0.000	0.000	5.420	0.000	0.000	-8.200	0.00	0.00	0.00	0.00	-70.00	0.00

CARDS B.4

JOINT		FLEXURAL SPRING CHARACTERISTICS: SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)	TORSIONAL SPRING CHARACTERISTICS: SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)
1	P	0.000	10.000	0.000	0.700	20.000	0.000	10.000	0.000	0.700	5.000
2	W	0.000	10.000	0.000	0.700	20.000	0.000	10.000	0.000	0.700	35.000
3	NP	0.000	5.000	0.000	0.700	25.000	0.000	10.000	0.000	0.700	35.000
4	HP	0.000	5.000	0.000	0.700	25.000	0.000	10.000	0.000	0.700	35.000
5	RH	0.000	10.000	0.000	0.700	70.000	0.000	0.800	0.000	0.700	40.000
6	RK	0.000	1.800	0.000	0.700	60.000	0.000	0.000	0.000	0.000	0.000
7	RA	0.000	7.000	0.000	0.700	35.000	0.000	10.000	0.000	0.700	26.000
8	LH	0.000	10.000	0.000	0.700	70.000	0.000	0.800	0.000	0.700	40.000
9	LK	0.000	1.800	0.000	0.700	60.000	0.000	0.000	0.000	0.000	0.000
10	LA	0.000	7.000	0.000	0.700	35.000	0.000	10.000	0.000	0.700	26.000
11	RS	0.000	10.000	0.000	0.700	122.500	0.000	10.000	0.000	0.700	65.000
12	RE	0.000	1.800	0.000	0.700	70.000	0.000	0.000	0.000	0.000	0.000
13	LS	0.000	10.000	0.000	0.700	122.500	0.000	10.000	0.000	0.700	65.000
14	LE	0.000	1.800	0.000	0.700	70.000	0.000	0.000	0.000	0.000	0.000

CARDS B.5

JOINT VISCOUS CHARACTERISTICS AND LOCK-UNLOCK CONDITIONS

JOINT		VISCOUS COEFFICIENT (IN. LB.SEC./DEG)	COULOMB FRICTION COEF. (IN. LB.)	FULL FRICTION ANGULAR VELOCITY (DEG./SEC.)	MAX TORQUE FOR A LOCKED JOINT (IN. LB.)	MIN TORQUE FOR UNLOCKED JOINT (IN. LB.)	MIN. ANG. VELOCITY FOR UNLOCKED JOINT (RAD/SEC.)	IMPULSE RESTITUTION COEFFICIENT
1	P	0.100	0.00	30.00	0.00	0.00	0.00	0.000
2	W	0.100	0.00	30.00	0.00	0.00	0.00	0.000
3	NP	0.100	0.00	30.00	0.00	0.00	0.00	0.000
4	HP	0.100	0.00	30.00	0.00	0.00	0.00	0.000
5	RH	0.100	0.00	30.00	0.00	0.00	0.00	0.000
6	RK	0.100	0.00	30.00	0.00	0.00	0.00	0.000
7	RA	0.100	0.00	30.00	0.00	0.00	0.00	0.000
8	LH	0.100	0.00	30.00	0.00	0.00	0.00	0.000
9	LK	0.100	0.00	30.00	0.00	0.00	0.00	0.000
10	LA	0.100	0.00	30.00	0.00	0.00	0.00	0.000
11	RS	0.100	0.00	30.00	0.00	0.00	0.00	0.000
12	RE	0.100	0.00	30.00	0.00	0.00	0.00	0.000
13	LS	0.100	0.00	30.00	0.00	0.00	0.00	0.000
14	LE	0.100	0.00	30.00	0.00	0.00	0.00	0.000

SEGMENT INTEGRATION CONVERGENCE TEST INPUT

SEGMENT NO.	SYM	ANGULAR VELOCITIES (RAD/SEC.) MAG. TEST	ABS. ERROR	REL. ERROR	LINEAR VELOCITIES (IN./SEC.) MAG. TEST	ABS. ERROR	REL. ERROR	ANGULAR ACCELERATIONS (RAD/SEC.**2) MAG. TEST	ABS. ERROR	REL. ERROR	LINEAR ACCELERATIONS (IN./SEC.**2) MAG. TEST	ABS. ERROR	REL. ERROR
1	LT	0.010	0.010	0.0100	0.010	0.010	0.0100	0.100	0.100	0.1000	0.100	0.100	0.0100
2	CT	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
3	UT	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
4	N	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
5	H	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
6	RUL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
7	RLL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
8	RF	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
9	LUL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
10	LLL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
11	LF	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
12	RUA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
13	RLA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
14	LUA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
15	LLA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000

VEHICLE DECELERATION INPUTS

SLED ACCELERATION - 20G PEAK

YAW	PITCH	ROLL	VIPS	VTIME	XO(X)	XO(Y)	XO(Z)	NATAB	ATO	ADT	MSEG
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15	0.000000	0.010000	0

UNIDIRECTIONAL VEHICLE POSITION TABLES

TIME (MSEC)	ACC (G)	VELOCITY (IN./SEC.)	POSITION (IN.)	TIME (MSEC)	ACC (G)	VELOCITY (IN./SEC.)	POSITION (IN.)
0.00000	0.00	0.0000	0.00000				
10.00000	5.00	-9.6522	-0.03217				
20.00000	10.00	-38.6088	-0.25739				
30.00000	15.00	-86.8698	-0.86870				
40.00000	20.00	-154.4352	-2.05914				
50.00000	15.00	-222.0006	-3.95740				
60.00000	10.00	-270.2616	-6.43480				
70.00000	5.00	-299.2182	-9.29829				
80.00000	0.00	-308.8704	-12.35482				
90.00000	0.00	-308.8704	-15.44352				
100.00000	0.00	-308.8704	-18.53222				
110.00000	0.00	-308.8704	-21.62093				
120.00000	0.00	-308.8704	-24.70963				
130.00000	0.00	-308.8704	-27.79834				
140.00000	0.00	-308.8704	-30.88704				

NPI	NBLT	NBAG	NELP	NQ	NSD	NHRNSS	NWINDF	NJNTF	NFORCE
12	0	0	3	0	0	1	0	0	0

CARD D.1

CARDS D.2

PLANE INPUTS

PLANE NO. 1 SEAT. 6 DEGREE OFF H

	X	Y	Z
POINT 1	10.0000	8.0000	-10.0000
POINT 2	28.0100	8.0000	-11.8900
POINT 3	10.0000	-8.0000	-10.0000

PLANE NO. 2 BACK PANEL. 13 DEGR

	X	Y	Z
POINT 1	1.0000	9.0000	-48.9700
POINT 2	10.0000	9.0000	-10.0000
POINT 3	1.0000	-9.0000	-48.9700

PLANE NO. 3 FLOOR.

	X	Y	Z
POINT 1	0.0000	12.0000	-1.3000
POINT 2	60.0000	12.0000	-1.3000
POINT 3	0.0000	-12.0000	-1.3000

PLANE NO. 4 HEAD PAD. 13 DEGR

	X	Y	Z
POINT 1	2.4800	7.5000	-47.2600
POINT 2	4.9600	7.5000	-36.5500
POINT 3	2.4800	-7.5000	-47.2600

PLANE NO. 5 SEAT FRONT PANEL.

	X	Y	Z
POINT 1	28.0100	8.0000	-11.8900
POINT 2	26.6600	8.0000	-4.4000
POINT 3	28.0100	-8.0000	-11.8900

PLANE NO. 6 BACK PANEL2. 13 DEGR

	X	Y	Z
POINT 1	1.0000	9.0000	-48.9700
POINT 2	10.0000	9.0000	-10.0000
POINT 3	1.0000	-9.0000	-48.9700

PLANE NO. 7 FIREWALL.

	X	Y	Z
POINT 1	60.0000	12.0000	-25.0000
POINT 2	60.0000	-12.0000	-25.0000
POINT 3	60.0000	12.0000	-0.7500

PLANE NO. 8 RIGHT SIDE SEAT/IN.

	X	Y	Z
POINT 1	8.4100	8.1000	-6.6600
POINT 2	8.7000	8.1000	-14.7300
POINT 3	30.5800	8.1000	-6.6400

PLANE NO. 9 LEFT SIDE SEAT/IN.

	X	Y	Z
POINT 1	8.4100	-8.1000	-6.6600
POINT 2	30.5800	-8.1000	-6.6400
POINT 3	8.7000	-8.1000	-14.7300

PLANE NO. 10 RUDDER PEDALS.

	X	Y	Z
POINT 1	49.9920	9.0000	-2.2392
POINT 2	52.9920	9.0000	-4.7565
POINT 3	49.9920	-9.0000	-2.2392

PLANE NO. 11 LEFT SIDE PANEL.

	X	Y	Z
POINT 1	1.0000	-9.0000	-48.9700
POINT 2	10.9000	-9.0000	-6.1000
POINT 3	-7.7700	-9.0000	-46.9500

PLANE NO. 12 RIGHT SIDE PANEL.

	X	Y	Z
POINT 1	1.0000	9.0000	-48.9700
POINT 2	-7.7700	9.0000	-46.9500
POINT 3	10.9000	9.0000	-6.1000

ADDITIONAL ELLIPSOID INPUT

CARDS D.5

NO.	SEMIAXES (IN.) X	Y	Z	OFFSET (IN.) X	Y	Z	ROTATION (DEG) YAW	PITCH	ROLL	POWER		
22	4.500	3.000	3.000	0.000	4.000	-3.500	0.000	0.000	0.000	0.	0.	0.
23	3.200	6.000	8.000	0.000	0.000	-7.000	0.000	0.000	0.000	0.	0.	0.
24	6.000	15.000	5.000	38.000	0.000	-28.000	0.000	0.000	0.000	20.	20.	20.

BODY SEGMENT SYMMETRY INPUT

CARD D.7

SEG NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NSYM(J)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FUNCTION NO. 3 SEGMENT-SEGMENT FCN. NTI(3) = 1

D0	D1	D2	D3	D4
0.0000	-5.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 6 TABULAR POINTS

D	F(D)
0.000000	0.0000
1.000000	470.0000
2.000000	890.0000
3.000000	1220.0000
4.000000	1470.0000
5.000000	1580.0000

FUNCTION NO. 6 CONSTANT, F=0.0 NTI(6) = 19

D0	D1	D2	D3	D4
0.0000	0.0000	0.0000	0.0000	0.0000

FUNCTION IS CONSTANT 0.000000

FUNCTION NO. 7 R FACTOR. NTI(7) = 24 CARDS E

D0	D1	D2	D3	D4
0.0000	0.0000	0.7000	0.0000	0.0000

FUNCTION IS CONSTANT 0.700000

FUNCTION NO. 13 STIFF SURFACES NTI(13) = 29 CARDS E

D0	D1	D2	D3	D4
0.0000	-4.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 8 TABULAR POINTS

D	F(D)
0.000000	0.0000
0.100000	5.0000
0.200000	20.0000
0.300000	40.0000
0.400000	60.0000
1.000000	860.0000
2.000000	2400.0000
3.000000	4000.0000

FUNCTION NO. 14 FRICTION FUNC. NTI(14) = 51 CARDS E

D0	D1	D2	D3	D4
0.0000	0.0000	0.5000	0.0000	1.0000

FUNCTION IS CONSTANT 0.500000

FUNCTION NO. 19 CF=.25,CREST=.25 NTI(19) = 56 CARDS E

D0	D1	D2	D3	D4
0.0000	0.0000	0.2500	0.0000	0.0000

FUNCTION IS CONSTANT 0.250000

FUNCTION NO. 20 DAMPING COEFF. C=900 NTI(20) = 61 CARDS E

D0	D1	D2	D3	D4
0.0000	1.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 5TH DEGREE POLYNOMIAL

A0	A1	A2	A3	A4	A5
0.000000	900.000000	0.000000	0.000000	0.000000	0.000000

FUNCTION NO. 21 RATE OF DEFLEC. NTI(21) = 72 CARDS E

D0	D1	D2	D3	D4
-40.0000	-150.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 21 TABULAR POINTS

D	F(D)
-40.000000	0.0000
-30.000000	0.0000
-20.000000	0.0000
-10.000000	0.0000
0.000000	0.0000
5.000000	1.0000
10.000000	1.0000
20.000000	0.9900
30.000000	0.9650
40.000000	0.9280
50.000000	0.8600
60.000000	0.6900
70.000000	0.4750
80.000000	0.3400
90.000000	0.2600
100.000000	0.2000
110.000000	0.1800
120.000000	0.0900
130.000000	0.0600
140.000000	0.0250
150.000000	0.0000

FUNCTION NO. 22 DAMPING COEFF. C=35 NTI(22) = 120 CARDS E

D0	D1	D2	D3	D4
0.0000	1.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 5TH DEGREE POLYNOMIAL

A0	A1	A2	A3	A4	A5
0.000000	35.000000	0.000000	0.000000	0.000000	0.000000

FUNCTION NO. 24 DAMPING COEFF. C=0.8 NTI(24) = 131 CARDS E

D0	D1	D2	D3	D4
-1000.0000	-1000.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 4 TABULAR POINTS

D	F(D)
-1000.000000	0.6000
-1.000000	0.6000
0.000000	1.0000
1000.000000	1.0000

FUNCTION NO. 25 DAMPING COEFF C=1100 NTI(25) = 145

D0	D1	D2	D3	D4
0.0000	1.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 5TH DEGREE POLYNOMIAL

A0	A1	A2	A3	A4	A5
0.000000	1100.000000	0.000000	0.000000	0.000000	0.000000

FUNCTION NO. 26 STIFF SURFACES-LL NTI(26) = 156 CARDS E

D0	D1	D2	D3	D4
0.0000	-4.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 8 TABULAR POINTS

D	F(D)
0.000000	0.0000
0.100000	5.0000
0.200000	20.0000
0.300000	40.0000
0.400000	60.0000
2.000000	860.0000
3.000000	2400.0000
4.000000	4000.0000

FUNCTION NO. 31 HARNESS FDF NTI(31) = 178 CARDS E

D0	D1	D2	D3	D4
0.0000	-4.0000	0.0000	0.0000	0.0000

FIRST PART OF FUNCTION - 8 TABULAR POINTS

D	F(D)
0.000000	0.0000
0.010000	150.0000
0.020000	300.0000
0.030000	450.0000
0.050000	850.0000
0.100000	3500.0000
1.000000	35000.0000
4.000000	140000.0000

FUNCTION NO. 32 HARNESS FRICTION NTI(32) = 200 CARDS E

D0	D1	D2	D3	D4
0.0000	0.0000	0.2000	0.0000	0.2000

FUNCTION IS CONSTANT 0.200000

FUNCTION NO. 34 HARNESS FRICTION NTI(34) = 205

D0	D1	D2	D3	D4
0.0000	0.0000	0.9000	0.0000	0.2000

FUNCTION IS CONSTANT 0.900000

CARDS F.1

PLANE	SEGMENT	FORCE DEFLECTION	INERTIAL SPIKE	R FACTOR	G FACTOR	FRICTION COEF.	OPT
1- 16	1- 1	13	-20	-21	0	14	1
SEAT. 6 DEGREE OFF H	LT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
1- 16	6- 6	13	-25	-21	0	14	1
SEAT. 6 DEGREE OFF H	RUL	STIFF SURFACES	DAMPING COEFF C=1100	RATE OF DEFLEC.		FRICTION FUNC.	
1- 16	9- 9	13	-25	-21	0	14	1
SEAT. 6 DEGREE OFF H	LUL	STIFF SURFACES	DAMPING COEFF C=1100	RATE OF DEFLEC.		FRICTION FUNC.	
2- 16	1- 1	13	-20	-21	0	14	1
BACK PANEL. 13 DEGR	LT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
2- 16	2- 2	13	-20	-21	0	14	1
BACK PANEL. 13 DEGR	CT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
2- 16	3- 3	13	-20	-21	0	14	1
BACK PANEL. 13 DEGR	UT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
3- 16	8- 8	13	-22	-21	0	14	-1
FLOOR.	RF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
3- 16	11- 11	13	-22	-21	0	14	-1
FLOOR.	LF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
4- 16	5- 5	13	-22	-21	0	14	1
HEAD PAD. 13 DEGR	H	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
10- 16	8- 8	13	-22	-21	0	14	1
RUDDER PEDALS.	RF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
10- 16	11- 11	13	-22	-21	0	14	1
RUDDER PEDALS.	LF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	

CARDS F.3

SEGMENT	SEGMENT	FORCE DEFLECTION	INERTIAL SPIKE	R FACTOR	G FACTOR	FRICTION COEF.	OPT
2- 2	13- 13	3	0	7	0	19	0
CT	RLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST=.25	
2- 2	15- 15	3	0	7	0	19	0
CT	LLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST=.25	
6- 6	13- 13	3	0	7	0	19	0
RUL	RLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST=.25	
9- 9	15- 15	3	0	7	0	19	0
LUL	LLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST=.25	
13- 13	16- 24	13	-22	-21	0	14	0
RLA	VEH	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
15- 15	16- 24	13	-22	-21	0	14	0
LLA	VEH	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	

NO. OF HARNESSES = 1

NO. OF BELTS PER HARNESS = 2

FOR HARNESS NO. 1 NO. OF POINTS PER BELT = 12 15

HARNESS NO. 1 BELT NO. 1 FUNCTION NOS. 31 0 0 0 0 REFERENCE SLACK = 0.000 IN.

CARDS F.8.D

K	KS	KE	NT	NPD	NDR	FUNCTION NOS.				
1	16	0	109	1	1	0	0	0	0	0
2	1	1	115	0	1	0	0	0	0	34
3	1	1	121	0	1	0	0	0	0	34
4	1	1	127	0	1	0	0	0	0	34
5	1	1	133	0	1	0	0	0	0	34
6	1	23	139	0	1	0	0	0	0	0
7	1	1	145	0	1	0	0	0	0	34
8	1	1	151	0	1	0	0	0	0	34
9	1	1	157	0	1	0	0	0	0	34
10	1	1	163	0	1	0	0	0	0	34
11	1	1	169	0	1	0	0	0	0	34
12	16	0	175	1	1	0	0	0	0	0

	BASE REFERENCE (IN.)			ADJUSTED REFERENCE (IN.)			OFFSET (IN.)			PREFERRED DIRECTION (IN.)		
K	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
1	13.000	8.000	-10.300	13.000	8.000	-10.300	0.000	0.000	0.000	2.400	22.000	-0.300
2	-1.178	7.075	-0.781	-1.178	7.075	-0.781	0.000	0.000	-0.072	0.000	0.000	0.000
3	-0.029	6.796	-1.534	-0.029	6.795	-1.534	0.000	0.000	-0.072	0.000	0.000	0.000
4	0.910	5.778	-2.283	0.910	5.778	-2.283	0.000	0.000	-0.072	0.000	0.000	0.000
5	2.228	2.355	-3.192	2.228	2.355	-3.192	0.000	0.000	-0.072	0.000	0.000	0.000
6	2.957	0.000	3.059	2.957	0.000	3.059	0.000	0.000	-7.000	0.000	0.000	0.000
7	3.070	-0.080	-4.410	2.344	-0.061	-3.367	0.000	0.000	-0.072	0.000	0.000	0.000
8	1.785	-2.325	-3.343	1.785	-2.325	-3.343	0.000	0.000	-0.072	0.000	0.000	0.000
9	0.011	-5.145	-2.728	0.011	-5.145	-2.728	0.000	0.000	-0.072	0.000	0.000	0.000
10	-0.880	-5.789	-2.282	-0.880	-5.789	-2.282	0.000	0.000	-0.072	0.000	0.000	0.000
11	-2.460	-6.099	-1.200	-2.460	-6.098	-1.200	0.000	0.000	-0.072	0.000	0.000	0.000
12	13.000	-8.000	-10.300	13.000	-8.000	-10.300	0.000	0.000	0.000	2.400	22.000	-0.300

HARNESS NO. 1 BELT NO. 2 FUNCTION NOS. 31 0 0 0 0 REFERENCE SLACK = 0.000 IN.

CARDS F.8.D

K	KS	KE	NT	NPD	NDR	FUNCTION NOS.				
13	16	0	187	1	1	0	0	0	0	0
14	1	1	193	0	1	0	0	0	0	32
15	1	1	199	0	1	0	0	0	0	32
16	1	23	205	0	1	0	0	0	0	0
17	1	1	211	0	1	0	0	0	0	32
18	2	2	217	0	1	0	0	0	0	32
19	2	2	223	0	1	0	0	0	0	32
20	3	3	229	0	1	0	0	0	0	32
21	3	3	235	0	1	0	0	0	0	32
22	3	3	241	0	1	0	0	0	0	32
23	3	3	247	0	1	0	0	0	0	32
24	3	22	253	0	0	0	0	0	0	32
25	3	3	259	0	1	0	0	0	0	32
26	3	3	265	0	1	0	0	0	0	32
27	16	0	271	1	1	0	0	0	0	0

	BASE REFERENCE (IN.)			ADJUSTED REFERENCE (IN.)			OFFSET (IN.)			PREFERRED DIRECTION (IN.)		
K	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
13	13.000	-8.000	-10.300	13.000	-8.000	-10.300	0.000	0.000	0.000	0.700	17.500	-21.300
14	-2.445	-6.101	-1.213	-2.445	-6.101	-1.213	0.000	0.000	-0.072	0.000	0.000	0.000
15	-0.960	-6.000	-2.500	-0.906	-5.661	-2.359	0.000	0.000	-0.072	0.000	0.000	0.000
16	0.000	-5.700	3.800	0.000	-5.367	3.578	0.000	0.000	-7.000	0.000	0.000	0.000
17	0.010	-4.000	-4.500	0.008	-3.061	-3.443	0.000	0.000	-0.072	0.000	0.000	0.000
18	1.818	-5.439	-1.820	1.818	-5.439	-1.820	0.000	0.000	-0.011	0.000	0.000	0.000
19	2.500	-2.500	-1.500	3.397	-3.397	-2.038	0.000	0.000	-0.011	0.000	0.000	0.000

20	3.000	-1.500	6.500	2.777	-1.388	6.016	0.000	0.000	-0.872	0.000	0.000	0.000
21	4.487	-0.133	3.734	4.487	-0.133	3.734	0.000	0.000	-0.872	0.000	0.000	0.000
22	4.421	3.319	-1.662	4.421	3.319	-1.662	0.000	0.000	-0.872	0.000	0.000	0.000
23	0.879	4.202	-5.672	0.879	4.202	-5.672	0.000	0.000	-0.872	0.000	0.000	0.000
24	0.300	0.200	-2.800	0.320	0.213	-2.985	0.000	4.000	-3.500	0.000	0.000	0.000
25	-1.000	4.300	-6.000	-0.955	4.105	-5.728	0.000	0.000	-0.872	0.000	0.000	0.000
26	-2.500	4.300	-4.000	-2.612	4.492	-4.179	0.000	0.000	-0.872	0.000	0.000	0.000
27	0.000	5.000	-35.200	0.000	5.000	-35.200	0.000	0.000	0.000	0.700	17.500	-21.300

CARD G.1

ZPLT(X)	ZPLT(Y)	ZPLT(Z)	I1	J1	I2	J2	I3	SPLT(1)	SPLT(2)	SPLT(3)
0.	0.	0.	0	0	0	0	0	10.00	6.00	1.00

INITIAL POSITIONS (INERTIAL REFERENCE) CARDS G.2

SEGMENT		LINEAR POSITION (IN.)			LINEAR VELOCITY (IN./SEC.)		
NO.	SEG	X	Y	Z	X	Y	Z
1	LT	14.38100	0.00000	-13.75000	0.00000	0.00000	0.00000
2	CT	13.16068	0.00000	-19.07188	0.00000	0.00000	0.00000
3	UT	11.31383	0.00000	-26.93796	0.00000	0.00000	0.00000
4	N	9.28353	0.00000	-35.53137	0.00000	0.00000	0.00000
5	H	7.77521	0.00000	-41.83338	0.00000	0.00000	0.00000
6	RUL	22.94073	3.42000	-14.48930	0.00000	0.00000	0.00000
7	RLL	38.16022	3.42000	-10.39045	0.00000	0.00000	0.00000
8	RF	48.12719	3.42000	-4.45598	0.00000	0.00000	0.00000
9	LUL	22.94073	-3.42000	-14.48930	0.00000	0.00000	0.00000
10	LLL	38.16022	-3.42000	-10.39045	0.00000	0.00000	0.00000
11	LF	48.12719	-3.42000	-4.45598	0.00000	0.00000	0.00000
12	RUA	12.34164	6.24000	-27.13188	0.00000	0.00000	0.00000
13	RLA	22.75808	6.24000	-21.48521	0.00000	0.00000	0.00000
14	LUA	12.34164	-6.24000	-27.13188	0.00000	0.00000	0.00000
15	LLA	22.75808	-6.24000	-21.48521	0.00000	0.00000	0.00000

INITIAL ANGULAR ROTATION AND VELOCITY CARDS G.3

SEGMENT		ANGULAR ROTATION (DEG)			ANGULAR VELOCITY (DEG/SEC.)			IYPR			
NO.	SEG	YAW	PITCH	ROLL	X	Y	Z				
1	LT	0.00000	12.90000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
2	CT	0.00000	12.95000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
3	UT	0.00000	13.28000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
4	N	0.00000	13.46000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
5	H	0.00000	13.46000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
6	RUL	0.00000	92.90000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
7	RLL	0.00000	48.65000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
8	RF	0.00000	128.80000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
9	LUL	0.00000	92.90000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
10	LLL	0.00000	48.65000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
11	LF	0.00000	128.80000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
12	RUA	0.00000	24.50000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
13	RLA	0.00000	85.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
14	LUA	0.00000	24.50000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
15	LLA	0.00000	85.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0

```
LINEAR AND ANGULAR VELOCITIES HAVE BEEN SET EQUAL TO THE INITIAL VEHICLE VELOCITIES.
HBPLAY TIME =     0.000 MSEC. NH,NB,NPTS NT=     1     1    11   103
NL(1)=       1       2       3       4       5       6       8       9      10      11      12
BB   =        4.124   1.402   1.574   3.779   2.557   2.656   3.388   1.187   1.940   4.738
HBPLAY TIME =     0.000 MSEC. NH,NB,NPTS NT=     1     2     7   181
NL(1)=      13      14      18      21      22      23      27
BB   =        4.748   7.394   6.842   6.406   5.423  10.829

TABULAR TIME HISTORY CONTROL PARAMETERS
 TYPE  KSG     SELECTED SEGMENTS OR JOINTS
  H.1   3      3 -5  5
     REF       0  1 16
  H.2   3      3  5  5
     REF       0  0  3
  H.3   3      3  5  5
     REF       0  0  3
  H.4   3      3  5  5
     REF       0  0 16
  H.5   3      3  5  5
     REF       0  0  5
  H.6   3      3  5  5
     REF       0  0  3
  H.7   2      3  4
     REF       0  0
```

H.8	0	
REF		
H.9	1	4
REF		5
H.10	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
REF		16

SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LT	0.0000	12.9000	0.0000	0.00000	0.00000	0.00000	0.000000	-26.834649	0.000000
2 CT	0.0000	12.9500	0.0000	0.00000	0.00000	0.00000	0.000000	40.304245	0.000000
3 UT	0.0000	13.2800	0.0000	0.00000	0.00000	0.00000	0.000000	-0.859459	0.000000
4 N	0.0000	13.4600	0.0000	0.00000	0.00000	0.00000	0.000000	13.637948	0.000000
5 H	0.0000	13.4600	0.0000	0.00000	0.00000	0.00000	0.000000	-1.165343	0.000000
6 RUL	0.0000	92.9000	0.0000	0.00000	0.00000	0.00000	0.000000	-2.405246	0.000000
7 RLL	0.0000	48.6500	0.0000	0.00000	0.00000	0.00000	0.000000	-12.215669	0.000000
8 RF	0.0000	128.8000	0.0000	0.00000	0.00000	0.00000	0.000000	56.318297	0.000000
9 LUL	0.0000	92.9000	0.0000	0.00000	0.00000	0.00000	0.000000	-2.405246	0.000000
10 LLL	0.0000	48.6500	0.0000	0.00000	0.00000	0.00000	0.000000	-12.215669	0.000000
11 LF	0.0000	128.8000	0.0000	0.00000	0.00000	0.00000	0.000000	56.318297	0.000000
12 RUA	0.0000	24.5000	0.0000	0.00000	0.00000	0.00000	0.000000	-6.917594	0.000000
13 RLA	0.0000	85.0000	0.0000	0.00000	0.00000	0.00000	0.000000	-34.722447	0.000000
14 LUA	0.0000	24.5000	0.0000	0.00000	0.00000	0.00000	0.000000	-6.917594	0.000000
15 LLA	0.0000	85.0000	0.0000	0.00000	0.00000	0.00000	0.000000	-34.722447	0.000000
16 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LT	14.3810	0.0000	-13.7500	0.00000	0.00000	0.00000	0.017822	0.000000	-0.088444
2 CT	13.1607	0.0000	-19.0719	0.00000	0.00000	0.00000	0.114863	0.000000	-0.110519
3 UT	11.3138	0.0000	-26.9380	0.00000	0.00000	0.00000	-0.038031	0.000000	-0.075446
4 N	9.2835	0.0000	-35.5314	0.00000	0.00000	0.00000	-0.042274	0.000000	-0.074372
5 H	7.7752	0.0000	-41.8334	0.00000	0.00000	0.00000	-0.047117	0.000000	-0.073212
6 RUL	22.9407	3.4200	-14.4893	0.00000	0.00000	0.00000	0.041548	0.000000	-0.039498
7 RLL	38.1602	3.4200	-10.3904	0.00000	0.00000	0.00000	-0.100994	0.000000	0.188268
8 RF	48.1272	3.4200	-4.4560	0.00000	0.00000	0.00000	-0.187590	0.000000	-0.183587
9 LUL	22.9407	-3.4200	-14.4893	0.00000	0.00000	0.00000	0.041548	0.000000	-0.039498
10 LLL	38.1602	-3.4200	-10.3904	0.00000	0.00000	0.00000	-0.100994	0.000000	0.188268
11 LF	48.1272	-3.4200	-4.4560	0.00000	0.00000	0.00000	-0.187590	0.000000	-0.183587
12 RUA	12.3416	6.2400	-27.1319	0.00000	0.00000	0.00000	-0.114274	0.000000	-0.038215
13 RLA	22.7581	6.2400	-21.4852	0.00000	0.00000	0.00000	-0.266915	0.000000	0.736709
14 LUA	12.3416	-6.2400	-27.1319	0.00000	0.00000	0.00000	-0.114274	0.000000	-0.038215
15 LLA	22.7581	-6.2400	-21.4852	0.00000	0.00000	0.00000	-0.266915	0.000000	0.736709
16 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT		(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1	LT	-0.1289E+03	0.0000E+00	-0.1135E+04	-0.63845E-15	-0.48015E+02	-0.60266E-16	0.00000E+00	0.00000E+00	0.00000E+00
2	CT	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
3	UT	0.6940E+02	0.0000E+00	0.3701E+03	-0.43592E-20	-0.31861E+01	0.13303E-17	0.00000E+00	0.00000E+00	0.00000E+00
4	N	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
5	H	0.7822E+02	0.0000E+00	0.3680E+03	-0.18372E-18	-0.26721E+00	0.42601E-16	0.00000E+00	0.00000E+00	0.00000E+00
6	RUL	-0.5309E+02	0.0000E+00	-0.1198E+03	0.46503E-17	0.21827E+02	0.67300E-15	0.00000E+00	0.00000E+00	0.00000E+00
7	RLL	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
8	RF	-0.9511E+01	0.0000E+00	-0.5210E+03	0.62882E-20	-0.17610E+03	0.23251E-17	0.00000E+00	0.00000E+00	0.00000E+00
9	LUL	-0.5309E+02	0.0000E+00	-0.1198E+03	0.46503E-17	0.21827E+02	0.67300E-15	0.00000E+00	0.00000E+00	0.00000E+00
10	LLL	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
11	LF	-0.9511E+01	0.0000E+00	-0.5210E+03	0.62882E-20	-0.17610E+03	0.23251E-17	0.00000E+00	0.00000E+00	0.00000E+00
12	RUA	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
13	RLA	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
14	LUA	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
15	LLA	0.0000E+00	0.0000E+00	0.3861E+03	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
								TOTAL BODY KINETIC ENERGY		
								0.00000E+00	0.00000E+00	0.00000E+00

JOINT		IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1	P	0	-0.177E+02	0.000E+00	-0.100E+03	0.0000E+00	0.0000E+00	0.0000E+00	0.000
2	W	0	-0.192E+02	0.000E+00	-0.859E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.000
3	NP	0	-0.312E+01	0.000E+00	-0.158E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.000
4	HP	0	-0.298E+01	0.000E+00	-0.122E+02	0.0000E+00	0.0000E+00	0.0000E+00	0.000
5	RH	0	0.274E+01	0.000E+00	0.653E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.000
6	RK	1	-0.132E+01	0.000E+00	-0.550E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000
7	RA	0	-0.339E+00	0.000E+00	0.242E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000
8	LH	0	0.274E+01	0.000E+00	0.653E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.000
9	LK	1	-0.132E+01	0.000E+00	-0.550E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000
10	LA	0	-0.339E+00	0.000E+00	0.242E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000
11	RS	0	-0.221E+01	0.000E+00	-0.731E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000
12	RE	1	-0.158E+01	0.000E+00	-0.155E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000
13	LS	0	-0.221E+01	0.000E+00	-0.731E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000
14	LE	1	-0.158E+01	0.000E+00	-0.155E+01	0.0000E+00	0.0000E+00	0.0000E+00	0.000

HARNESS BELT RESULTS FOR TIME = 0.000 MSEC.

POINT NO.	POINT INDEX	SEGMENT NO.	LENGTH (IN.)	BELT STRAIN ENERGY LOSS (IN. LB.)	(LOCAL OR ELLIPSOID) REFERENCE POINT (IN.) X	Y	Z	(INERTIAL) BELT FORCES (LB.) X	Y	Z	PENETRATION ENERGY LOSS (IN. LB.)
BELT NO. 1 OF HARNESS NO. 1											
1	1	16	0.000	0.000	13.000	8.000	-10.300	0.000	0.000	0.000	0.000
2	2	1	4.124	0.000	-1.178	7.075	-0.781	0.000	0.000	0.000	0.000
3	3	1	1.402	0.000	-0.029	6.795	-1.534	0.000	0.000	0.000	0.000
4	4	1	1.574	0.000	0.910	5.778	-2.283	0.000	0.000	0.000	0.000
5	5	1	3.779	0.000	2.228	2.355	-3.192	0.000	0.000	0.000	0.000
6	6	1	2.557	0.000	2.957	0.000	3.059	0.000	0.000	0.000	0.000
7	8	1	2.656	0.000	1.785	-2.325	-3.343	0.000	0.000	0.000	0.000
8	9	1	3.388	0.000	0.011	-5.145	-2.728	0.000	0.000	0.000	0.000
9	10	1	1.187	0.000	-0.880	-5.789	-2.282	0.000	0.000	0.000	0.000
10	11	1	1.940	0.000	-2.460	-6.098	-1.200	0.000	0.000	0.000	0.000
11	12	16	4.738	0.000	13.000	-8.000	-10.300	0.000	0.000	0.000	0.000
TOTAL BELT ENERGY LOSS				0.000							0.000
BELT NO. 2 OF HARNESS NO. 1											
12	13	16	0.000	0.000	13.000	-8.000	-10.300	0.000	0.000	0.000	0.000
13	14	1	4.748	0.000	-2.445	-6.101	-1.213	0.000	0.000	0.000	0.000
14	18	2	7.394	0.000	1.818	-5.439	-1.820	0.000	0.000	0.000	0.000
15	21	3	6.842	0.000	4.487	-0.133	3.734	0.000	0.000	0.000	0.000
16	22	3	6.406	0.000	4.421	3.319	-1.662	0.000	0.000	0.000	0.000
17	23	3	5.423	0.000	0.879	4.202	-5.672	0.000	0.000	0.000	0.000
18	27	16	10.829	0.000	0.000	5.000	-35.200	0.000	0.000	0.000	0.000
TOTAL BELT ENERGY LOSS				0.000							0.000
TOTAL HARNESS ENERGY LOSS				0.000							0.000

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HPTURB ITER =  10 AT TIME =  16.000 MSEC.  DELMAX =  0.010537  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  18.000 MSEC.  DELMAX =  0.009232  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  19.000 MSEC.  DELMAX =  0.009627  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  20.000 MSEC.  DELMAX =  0.010050  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  21.000 MSEC.  DELMAX =  0.010116  SCALE =  1.000000
HBPLAY TIME =    22.000 MSEC. NH,NB,NPTS NT=    1     2     8    181
NL(1)=      13      14      18      21      22      23      24      27
BB   =         4.748   7.394   6.842   6.406   5.423   0.491  10.338
HPTURB ITER =  10 AT TIME =  22.000 MSEC.  DELMAX =  0.012849  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  23.000 MSEC.  DELMAX =  0.011517  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  24.000 MSEC.  DELMAX =  0.011234  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  25.000 MSEC.  DELMAX =  0.011569  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  26.000 MSEC.  DELMAX =  0.012320  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  28.000 MSEC.  DELMAX =  0.010639  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  29.000 MSEC.  DELMAX =  0.012461  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  30.000 MSEC.  DELMAX =  0.014987  SCALE =  1.000000
HBPLAY TIME =    31.000 MSEC. NH,NB,NPTS NT=    1     2     7    181
NL(1)=      13      14      18      21      22      24      27
BB   =         4.748   7.394   6.842   6.406   5.572  10.679
HPTURB ITER =  10 AT TIME =  31.000 MSEC.  DELMAX =  0.021341  SCALE =  1.000000
HBPLAY TIME =    32.000 MSEC. NH,NB,NPTS NT=    1     2     8    181
NL(1)=      13      14      18      21      22      23      24      27
BB   =         4.748   7.394   6.842   6.406   5.066   0.260  10.926
HPTURB ITER =  10 AT TIME =  32.000 MSEC.  DELMAX =  0.016547  SCALE =  1.000000
HBPLAY TIME =    33.000 MSEC. NH,NB,NPTS NT=    1     2     7    181
NL(1)=      13      14      18      21      22      23      27
BB   =         4.748   7.394   6.842   6.406   5.066  11.186
HPTURB ITER =  10 AT TIME =  33.000 MSEC.  DELMAX =  0.036770  SCALE =  1.000000
HBPLAY TIME =    34.000 MSEC. NH,N`,NPTS NT=    1     2     8    181
NL(1)=      13      14      18      21      22      23      24      27
BB   =         4.748   7.394   6.842   6.406   5.066   0.289  10.896
HPTURB ITER =  10 AT TIME =  34.000 MSEC.  DELMAX =  0.041013  SCALE =  1.000000
HBPLAY TIME =    35.000 MSEC. NH,NB,NPTS NT=    1     2     7    181
NL(1)=      13      14      18      21      22      24      27
BB   =         4.748   7.394   6.842   6.406   5.216  11.035
HPTURB ITER =  10 AT TIME =  35.000 MSEC.  DELMAX =  0.021221  SCALE =  1.000000
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HBPLAY TIME =    36.000 MSEC. NH,NB,NPTS NT=    1    2    8   181
NL(1)=      13      14      18      21      22      23      24      27
BB  =         4.748   7.394   6.842   6.406   4.847   0.195  11.210
HPTURB ITER =  10 AT TIME =  36.000 MSEC.  DELMAX =  0.012648  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  37.000 MSEC.  DELMAX =  0.015643  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  38.000 MSEC.  DELMAX =  0.011152  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  39.000 MSEC.  DELMAX =  0.014391  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  40.000 MSEC.  DELMAX =  0.017690  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  41.000 MSEC.  DELMAX =  0.015081  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  42.000 MSEC.  DELMAX =  0.017005  SCALE =  1.000000
HBPLAY TIME =    43.000 MSEC. NH,NB,NPTS NT=    1    2    7   181
NL(1)=      13      14      18      21      22      24      27
BB  =         4.748   7.394   6.842   6.406   4.910  11.342
HPTURB ITER =  10 AT TIME =  43.000 MSEC.  DELMAX =  0.053120  SCALE =  1.000000
HBPLAY TIME =    44.000 MSEC. NH,NB,NPTS NT=    1    2    8   181
NL(1)=      13      14      18      21      22      23      24      27
BB  =         4.748   7.394   6.842   6.406   4.496   0.075  11.681
HPTURB ITER =  10 AT TIME =  44.000 MSEC.  DELMAX =  0.013932  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  45.000 MSEC.  DELMAX =  0.012674  SCALE =  1.000000
HBPLAY TIME =    46.000 MSEC. NH,NB,NPTS NT=    1    2    7   181
NL(1)=      13      18      21      22      23      24      27
BB  =        12.143   6.842   6.406   4.496   0.055  11.701
HPTURB ITER =  10 AT TIME =  46.000 MSEC.  DELMAX =  0.014891  SCALE =  1.000000
HBPLAY TIME =    47.000 MSEC. NH,NB,NPTS NT=    1    1   10   103
NL(1)=       1       3       4       5       6       8       9      10      11      12
BB  =         5.526   1.574   3.779   2.557   2.656   3.388   1.187   1.940   4.738
HPTURB ITER =  10 AT TIME =  47.000 MSEC.  DELMAX =  0.018982  SCALE =  1.000000
HBPLAY TIME =    48.000 MSEC. NH,NB,NPTS NT=    1    2    6   181
NL(1)=      13      18      21      22      24      27
BB  =        12.143   6.842   6.406   4.534  11.718
HPTURB ITER =  10 AT TIME =  48.000 MSEC.  DELMAX =  0.064777  SCALE =  1.000000
HBPLAY TIME =    49.000 MSEC. NH,NB,NPTS NT=    1    2    7   181
NL(1)=      13      18      21      22      23      24      27
BB  =        12.143   6.842   6.406   4.192   0.045  12.015
HPTURB ITER =  10 AT TIME =  49.000 MSEC.  DELMAX =  0.010077  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  50.000 MSEC.  DELMAX =  0.010283  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  51.000 MSEC.  DELMAX =  0.012303  SCALE =  1.000000
HBPLAY TIME =    52.000 MSEC. NH,NB,NPTS NT=    1    2    6   181
NL(1)=      13      18      21      22      24      27
BB  =        12.143   6.842   6.406   4.222  12.029
HPTURB ITER =  10 AT TIME =  52.000 MSEC.  DELMAX =  0.055553  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  53.000 MSEC.  DELMAX =  0.035482  SCALE =  1.000000
HBPLAY TIME =    54.000 MSEC. NH,NB,NPTS NT=    1    1    9   103
NL(1)=       1       3       4       5       6       8       9      10      12
BB  =         5.526   1.574   3.779   2.557   2.656   3.388   1.187   6.678
HPTURB ITER =  10 AT TIME =  54.000 MSEC.  DELMAX =  0.024287  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  55.000 MSEC.  DELMAX =  0.015678  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  56.000 MSEC.  DELMAX =  0.011486  SCALE =  1.000000
HBPLAY TIME =    57.000 MSEC. NH,NB,NPTS NT=    1    2    7   181
NL(1)=      13      18      19      21      22      24      27
BB  =        12.143   1.887   4.955   6.406   3.880  12.372
HPTURB ITER =  10 AT TIME =  57.000 MSEC.  DELMAX =  0.385309  SCALE =  0.259532
HBPLAY TIME =    58.000 MSEC. NH,NB,NPTS NT=    1    2    8   181
NL(1)=      13      18      19      20      21      22      24      27
BB  =        12.143   1.887   1.817   3.139   6.406   3.880  12.372
HPTURB ITER =  10 AT TIME =  58.000 MSEC.  DELMAX =  0.443658  SCALE =  0.225399
HBPLAY TIME =    59.000 MSEC. NH,NB,NPTS NT=    1    2    9   181
NL(1)=      13      16      18      19      20      21      22      24      27
BB  =         7.889   4.253   1.887   1.817   3.139   6.406   3.974  12.277
HPTURB ITER =  10 AT TIME =  59.000 MSEC.  DELMAX =  0.052001  SCALE =  1.000000
HBPLAY TIME =    60.000 MSEC. NH,NB,NPTS NT=    1    2    8   181
NL(1)=      13      18      19      20      21      22      24      27
BB  =        12.143   1.887   1.817   3.139   6.406   4.086  12.165
HPTURB ITER =  10 AT TIME =  60.000 MSEC.  DELMAX =  0.057808  SCALE =  1.000000
HBPLAY TIME =    61.000 MSEC. NH,NB,NPTS NT=    1    2    7   181
NL(1)=      13      18      20      21      22      24      27
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BB  =        12.143   3.703   3.139   6.406   4.156  12.096
HPTURB ITER =  10 AT TIME =  61.000 MSEC.  DELMAX =  0.015872  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  62.000 MSEC.  DELMAX =  0.022130  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  63.000 MSEC.  DELMAX =  0.015337  SCALE =  1.000000
HBPLAY TIME =    64.000 MSEC. NH,NB,NPTS NT=     1     2     6   181
NL(1)=      13      18      20      21      22      27
BB  =        12.143   3.703   3.139   6.406  16.252
HPTURB ITER =  10 AT TIME =  64.000 MSEC.  DELMAX =  0.011067  SCALE =  1.000000
HBPLAY TIME =    66.000 MSEC. NH,NB,NPTS NT=     1     1     8   103
NL(1)=       1       3       4       5       6       8       9      12
BB  =         5.526   1.574   3.779   2.557   2.656   3.388   7.865
HPTURB ITER =  10 AT TIME =  67.000 MSEC.  DELMAX =  0.011853  SCALE =  1.000000
HPTURB ITER =  10 AT TIME =  69.000 MSEC.  DELMAX =  0.013454  SCALE =  1.000000
DINT CONV. TEST    72.000   N    ANG VEL    22.55     0.2652E-02  0.1176E-03  0.1000E-03  0.1000E-03  0.1000E-03
TEST FAILED AT TIME =   0.072000 FOR H =   0.001000
DINT CONV. TEST    73.000   N    ANG VEL    23.86     0.3624E-02  0.1518E-03  0.1000E-03  0.1000E-03  0.1000E-03
TEST FAILED AT TIME =   0.073000 FOR H =   0.001000
DINT CONV. TEST    74.000   N    ANG VEL    26.11     0.3039E-02  0.1164E-03  0.1000E-03  0.1000E-03  0.1000E-03
TEST FAILED AT TIME =   0.074000 FOR H =   0.001000
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SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LT	10.9078	40.4616	-2.5237	-3.50101	6.77176	3.01702	-712.525840	-923.312215	-344.896206
2 CT	5.8648	8.3877	-35.0629	-28.78011	38.13662	26.32712	2669.823693	4863.705047	714.436127
3 UT	22.6603	16.1876	4.2073	-4.55898	-8.33212	11.28470	-833.189016	-740.536145	24.730106
4 N	9.4134	-28.3216	9.0212	3.10468	-11.10456	11.62142	-474.529280	-2359.202266	525.452345
5 H	-14.7037	-62.0894	29.6482	16.06835	-58.33883	6.84809	321.909906	-351.659928	252.225950
6 RUL	11.0166	100.4701	10.5736	-0.26043	-3.94123	-2.59116	-82.766870	-780.201793	66.972956
7 RLL	-2.0078	53.9069	-3.2449	-2.05452	9.15294	-1.60027	12.275725	-89.117047	79.212811
8 RF	-1.2125	146.0433	2.4774	3.41634	1.03537	-1.56581	-92.295830	747.087282	-23.919556
9 LUL	4.3688	101.7927	4.4680	-0.37199	-3.33541	-0.44435	-290.296221	-679.956632	528.292675
10 LLL	-0.9289	45.3497	-1.2981	-0.57596	5.97768	0.06395	278.790376	-4.508497	528.778813
11 LF	-0.5610	155.8698	1.6050	1.79239	0.13205	-0.59660	-177.520463	1209.576341	196.625307
12 RUA	-75.0950	70.5657	-80.2833	-6.23227	-4.14211	-1.63954	244.397026	-3261.631888	-168.345676
13 RLA	-21.0534	51.2884	-31.6271	-6.18955	1.21106	1.79408	113.635227	2487.522772	-303.100898
14 LUA	-17.8558	62.4794	-23.3643	-2.95595	-0.00123	5.46149	322.014085	-2838.181404	888.201239
15 LLA	-16.0460	60.3973	-21.7744	-2.73881	-15.25083	5.57354	441.700348	4146.746554	916.611637
16 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LT	6.0377	0.0702	-13.0395	-334.65671	-2.92122	-92.21272	1.118456	-3.419755	-24.241372
2 CT	3.5221	-1.5083	-17.2697	-403.89532	-63.36301	-39.55188	-7.411998	0.308363	-23.341359
3 UT	1.5893	-2.7194	-24.7657	-399.28403	-115.11128	-20.63141	-8.535068	3.408484	-20.077252
4 N	-0.4641	-2.8941	-33.1662	-319.46157	-121.58509	-38.64033	16.009901	-4.901599	-22.093312
5 H	4.8868	-1.0902	-36.0984	-178.47710	-69.83431	287.80272	-29.256214	-10.703850	8.134162
6 RUL	13.6013	3.3950	-14.9332	-345.17072	-4.32318	-59.80904	2.896528	-1.986709	-14.025632
7 RLL	29.0739	3.6383	-12.6201	-300.76311	12.64266	-73.16830	3.883535	0.620604	6.154392
8 RF	39.4986	3.6714	-8.4455	-258.02278	23.08008	-137.61724	0.173190	0.601745	-0.915789
9 LUL	15.0441	-3.3466	-14.9210	-314.88548	2.85212	-60.25035	6.374569	3.680291	-3.334002
10 LLL	29.7934	-3.3024	-12.0614	-278.81100	10.63011	-57.36381	9.156247	6.479980	13.521611
11 LF	39.2761	-3.3229	-7.6097	-244.93381	11.69052	-92.38042	4.608846	0.164379	1.561647
12 RUA	3.1574	3.4023	-29.0240	-426.99852	-109 61718	-32.04897	-2.643843	6.759738	6.506879
13 RLA	15.1710	5.9986	-24.3530	-429.54688	-25.03050	-46.34975	23.116917	3.958924	9.885922
14 LUA	7.1965	-8.0306	-27.9271	-282.38560	-78.35066	-29.72059	-9.173876	2.088389	27.959874
15 LLA	19.2594	-6.2444	-21.8664	-343.80786	-23.50199	71.96752	11.107168	-20.329519	-12.311189
16 VEH	-12.3548	0.0000	0.0000	-308.87040	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT		(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1	LT	-0.3009E+03	0.1559E+02	-0.2698E+05	-0.60308E+03	-0.27927E+04	-0.22971E+03	0.54266E+04	0.41308E+02	0.54679E+04
2	CT	0.2569E+03	-0.5220E+03	-0.6204E+03	0.88429E+04	0.83818E+04	0.71444E+03	0.28620E+04	0.54259E+03	0.34046E+04
3	UT	-0.6894E+03	-0.2430E+03	0.4419E+03	-0.69029E+03	-0.15455E+03	0.16513E+02	0.12032E+05	0.28218E+03	0.12314E+05
4	N	0.0000E+00	0.0000E+00	0.3861E+03	-0.26984E+04	0.10411E+05	0.52545E+03	0.50402E+03	0.33066E+01	0.50733E+03
5	H	0.0000E+00	0.0000E+00	0.3861E+03	-0.35125E+03	0.92855E+03	0.25223E+03	0.18467E+04	0.56365E+03	0.24104E+04
6	RUL	0.1244E+03	-0.7761E+01	0.5426E+02	-0.23939E+01	0.52884E+02	-0.10354E+01	0.36122E+04	0.16567E+02	0.36287E+04
7	RLL	0.0000E+00	0.0000E+00	0.3861E+03	-0.82176E+01	-0.24413E+03	-0.15598E+03	0.12134E+04	0.22031E+02	0.12355E+04
8	RF	0.0000E+00	0.0000E+00	0.3861E+03	-0.18022E+03	0.11120E+04	-0.75866E+03	0.23167E+03	0.27743E+00	0.23195E+03
9	LUL	-0.1221E+04	0.2472E+04	0.2645E+04	-0.70853E+03	-0.12076E+04	-0.31901E+03	0.30251E+04	0.11362E+02	0.30365E+04
10	LLL	0.0000E+00	0.0000E+00	0.3861E+03	-0.66486E+01	-0.17362E+03	-0.14022E+03	0.10259E+04	0.89964E+01	0.10349E+04
11	LF	0.0000E+00	0.0000E+00	0.3861E+03	-0.20969E+03	0.81201E+03	-0.72214E+02	0.18487E+03	0.69768E-01	0.18494E+03
12	RUA	0.0000E+00	0.0000E+00	0.3861E+03	-0.44483E+02	-0.70077E+04	0.79493E+03	0.14022E+04	0.49151E+01	0.14071E+04
13	RLA	-0.8603E+02	-0.4004E+01	0.7761E+03	0.31299E+02	0.34441E+04	-0.57371E+02	0.14312E+04	0.66593E+01	0.14379E+04
14	LUA	0.0000E+00	0.0000E+00	0.3861E+03	-0.16398E+03	-0.90273E+03	0.56251E+02	0.62271E+03	0.11478E+01	0.62386E+03
15	LLA	-0.9690E+04	-0.7116E+04	-0.3749E+04	0.20275E+04	0.70096E+04	0.12476E+04	0.94712E+03	0.40319E+02	0.98744E+03
								TOTAL BODY KINETIC ENERGY		
								0.36368E+05	0.15454E+04	0.37913E+05

JOINT		IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1	P	0	-0.478E+03	0.156E+03	-0.120E+04	0.1437E+04	0.1730E+04	-0.4588E+03	47.900
2	W	0	-0.373E+03	0.134E+03	-0.919E+03	-0.2162E+04	-0.6568E+03	0.7903E+03	63.460
3	NP	0	-0.296E+03	-0.144E+03	0.914E+01	-0.2178E+03	0.5526E+03	0.5465E+02	4.653
4	HP	0	-0.349E+03	-0.128E+03	0.851E+02	-0.8035E+02	0.2872E+03	0.4001E+02	48.641
5	RH	0	0.968E+02	-0.374E+02	-0.276E+03	0.1549E+01	0.6042E+02	0.1998E+02	11.110
6	RK	1	0.383E+02	0.731E+01	0.463E+02	-0.9820E+01	-0.7377E+02	0.4208E+02	13.094
7	RA	0	0.360E+00	0.125E+01	-0.398E+01	0.6057E+01	0.4563E+02	0.6082E+01	8.104
8	LH	0	0.316E+03	0.174E+01	-0.108E+03	-0.1049E+02	0.5690E+02	0.2195E+02	10.800
9	LK	1	0.990E+02	0.636E+02	0.123E+03	-0.1739E+03	-0.4959E+02	0.2365E+03	9.313
10	LA	0	0.958E+01	0.342E+00	0.117E+01	0.8697E+01	0.3333E+02	0.3159E+01	6.037
11	RS	0	0.123E+03	0.609E+02	0.770E+02	0.2329E+02	-0.3963E+02	0.2492E+02	9.125
12	RE	1	0.138E+03	0.234E+02	0.465E+02	-0.5987E+02	0.1090E+04	-0.4321E+03	5.353
13	LS	0	0.163E+03	0.378E+00	0.134E+03	-0.7896E+01	-0.5782E+02	0.3755E+02	12.112
14	LE	1	0.214E+03	-0.112E+02	-0.153E+02	-0.1860E+03	0.1440E+03	0.2989E+03	15.250

POSTPROCESSOR CONTROL PARAMETERS

	HIC & HSI POINT	CSI POINT
H.11	2	1

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

POINT TOTAL ACCELERATION (G'S)

	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 3 - UT IN UT REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. -5 - H ACCELEROMETER (1G)				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN VEH REFERENCE			
TIME (MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	-0.020	0.000	-0.082	0.084	-0.262	0.000	0.890	0.928	-0.047	0.000	-0.073	0.087
2.000	-0.014	0.000	-0.107	0.108	-0.260	0.000	0.865	0.903	-0.051	0.000	-0.098	0.111
4.000	-0.007	0.000	-0.179	0.179	-0.258	0.000	0.793	0.834	-0.067	0.000	-0.168	0.181
6.000	-0.006	-0.003	-0.247	0.247	-0.269	0.000	0.725	0.774	-0.093	0.000	-0.232	0.250
8.000	-0.019	-0.012	-0.314	0.315	-0.306	-0.002	0.658	0.725	-0.144	-0.002	-0.289	0.323
10.000	-0.061	-0.023	-0.386	0.391	-0.379	-0.005	0.586	0.698	-0.233	-0.005	-0.342	0.413
12.000	-0.091	-0.032	-0.464	0.474	-0.475	-0.008	0.507	0.695	-0.344	-0.008	-0.396	0.525
14.000	-0.099	-0.023	-0.547	0.556	-0.487	-0.006	0.425	0.646	-0.375	-0.006	-0.474	0.604
16.000	-0.132	-0.024	-0.623	0.638	-0.506	-0.007	0.348	0.614	-0.411	-0.007	-0.544	0.682
18.000	-0.111	-0.005	-0.719	0.727	-0.510	-0.003	0.253	0.570	-0.437	-0.003	-0.635	0.771
20.000	-0.133	-0.001	-0.791	0.802	-0.525	-0.002	0.181	0.555	-0.468	-0.002	-0.702	0.844
22.000	-0.197	-0.016	-0.854	0.876	-0.551	-0.005	0.119	0.564	-0.509	-0.006	-0.756	0.911
24.000	-0.382	-0.063	-1.317	1.373	-0.662	-0.179	-0.342	0.767	-0.724	-0.179	-1.179	1.395
26.000	-0.390	-0.112	-1.296	1.358	-0.685	-0.231	-0.314	0.788	-0.739	-0.231	-1.147	1.384
28.000	-0.357	0.556	-1.166	1.340	-0.682	-0.014	-0.181	0.705	-0.705	-0.014	-1.019	1.239
30.000	-0.438	0.816	-1.246	1.553	-0.702	0.035	-0.256	0.748	-0.742	0.035	-1.087	1.317
32.000	-2.733	-0.835	-0.461	2.895	-1.271	-0.218	0.576	1.412	-1.106	-0.220	-0.149	1.137
34.000	-2.186	-0.420	-0.403	2.263	-1.208	-0.216	0.667	1.397	-1.025	-0.219	-0.076	1.051
36.000	-3.145	-0.474	-0.313	3.196	-1.481	-0.353	0.849	1.743	-1.252	-0.357	0.159	1.312
38.000	-4.178	-0.580	-1.221	4.391	-1.843	-0.709	0.133	1.979	-1.769	-0.710	-0.467	1.963
40.000	-5.137	0.364	-1.250	5.299	-2.004	-0.530	0.280	2.092	-1.897	-0.533	-0.297	1.993
42.000	-6.838	1.397	-2.254	7.334	-2.388	-0.543	-0.390	2.479	-2.417	-0.540	-0.885	2.630
44.000	-14.419	-3.743	0.830	14.920	-4.097	-1.242	3.893	5.787	-3.227	-1.300	3.624	5.024
46.000	-16.621	-1.760	-0.518	16.722	-4.375	-1.075	3.474	5.689	-3.633	-1.143	3.226	4.991
48.000	-21.535	0.772	0.632	21.558	-4.411	-0.608	5.515	7.088	-3.372	-0.744	5.190	6.234
50.000	-41.704	-14.755	6.467	44.707	-8.393	-3.295	18.145	20.262	-5.470	-3.858	18.124	19.321
52.000	-46.097	-12.754	8.809	48.633	-8.850	-2.015	24.198	25.844	-5.684	-2.996	24.033	24.877
54.000	-59.506	-18.177	14.142	63.807	-11.972	-2.812	40.775	42.589	-8.224	-4.949	40.493	41.615
56.000	-60.433	-15.422	13.472	63.808	-11.763	-2.643	48.226	49.710	-9.706	-5.876	47.398	48.737
58.000	-73.471	-17.978	-2.410	75.677	-11.839	-4.818	45.094	46.871	-12.593	-8.610	43.319	45.927
60.000	-93.922	-15.685	14.909	96.382	-10.687	1.243	64.829	65.716	-16.338	-5.515	62.414	64.752
62.000	-39.398	-7.543	-3.263	40.247	-8.458	0.385	50.073	50.783	-16.781	-5.749	46.585	49.848
64.000	-13.416	-3.242	-10.799	17.525	-4.985	0.413	34.219	34.583	-13.561	-4.374	30.511	33.674
66.000	2.837	-2.587	-20.041	20.406	-4.396	-0.971	17.138	17.719	-9.978	-3.581	13.198	16.929
68.000	12.171	-3.027	-29.353	31.921	-6.574	-2.288	10.559	12.647	-10.367	-3.898	5.106	12.195
70.000	12.817	-4.431	-27.755	30.891	-6.991	-2.721	11.812	13.993	-11.904	-4.656	4.693	13.617
72.000	8.827	-2.877	-26.335	27.924	-5.142	-2.316	12.679	13.876	-11.519	-4.665	5.172	13.461
74.000	3.362	-1.720	-32.445	32.664	-5.688	-2.458	13.892	15.211	-13.307	-5.198	4.223	14.897
76.000	-2.984	1.218	-32.702	32.861	-6.355	-2.850	21.202	22.317	-19.656	-7.488	6.458	22.003
78.000	-4.104	3.348	-30.967	31.417	-5.758	-2.791	26.452	27.215	-24.295	-9.144	7.173	26.932
80.000	-0.706	4.868	-21.526	22.081	-3.903	-2.154	32.157	32.464	-29.256	-10.704	8.134	32.197

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

POINT REL. VELOCITY (IN./SEC.)

TIME	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 3 - UT IN VEH REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN VEH REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN UT REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.357	0.000	-0.064	0.362	0.349	0.000	-0.062	0.355	-0.008	0.000	0.000	0.008
4.000	1.482	0.000	-0.168	1.491	1.463	0.000	-0.163	1.472	-0.020	0.000	0.000	0.020
6.000	3.368	-0.002	-0.329	3.384	3.332	0.000	-0.320	3.347	-0.037	0.002	0.000	0.037
8.000	6.010	-0.010	-0.534	6.034	5.944	-0.002	-0.519	5.967	-0.067	0.008	0.000	0.068
10.000	9.392	-0.024	-0.792	9.425	9.275	-0.005	-0.764	9.307	-0.120	0.019	0.000	0.121
12.000	13.502	-0.048	-1.096	13.546	13.296	-0.010	-1.048	13.338	-0.211	0.038	0.000	0.214
14.000	18.360	-0.073	-1.462	18.418	18.037	-0.016	-1.386	18.090	-0.332	0.057	0.000	0.336
16.000	23.966	-0.096	-1.885	24.040	23.526	-0.022	-1.782	23.593	-0.452	0.074	-0.001	0.458
18.000	30.318	-0.118	-2.369	30.411	29.761	-0.028	-2.239	29.845	-0.572	0.090	-0.001	0.579
20.000	37.426	-0.138	-2.913	37.539	36.747	-0.034	-2.754	36.851	-0.697	0.104	-0.001	0.704
22.000	45.254	-0.173	-3.495	45.389	44.477	-0.043	-3.312	44.601	-0.798	0.130	-0.001	0.808
24.000	53.624	-0.222	-4.417	53.806	52.814	-0.157	-4.225	52.983	-0.832	0.065	-0.001	0.835
26.000	62.779	-0.294	-5.297	63.002	61.919	-0.307	-5.089	62.128	-0.885	-0.012	0.003	0.885
28.000	72.709	-0.176	-6.137	72.968	71.793	-0.419	-5.907	72.037	-0.945	-0.242	0.010	0.975
30.000	83.403	0.352	-6.915	83.690	82.451	-0.398	-6.666	82.721	-0.986	-0.749	0.019	1.238
32.000	94.080	0.535	-7.240	94.360	93.727	-0.423	-7.110	93.997	-0.376	-0.957	0.041	1.029
34.000	104.889	0.071	-7.234	105.138	105.604	-0.633	-7.306	105.859	0.710	-0.706	0.097	1.006
36.000	116.510	-0.408	-7.277	116.737	118.233	-0.984	-7.495	118.474	1.722	-0.585	0.197	1.830
38.000	127.722	-1.024	-7.102	127.923	131.306	-1.474	-7.573	131.533	3.590	-0.474	0.404	3.643
40.000	139.233	-1.201	-6.715	139.400	145.087	-1.867	-7.440	145.290	5.849	-0.719	0.720	5.937
42.000	149.450	-0.660	-6.479	149.592	158.571	-2.237	-7.528	158.765	9.079	-1.685	1.225	9.315
44.000	155.812	-0.836	-4.740	155.887	170.774	-2.712	-6.337	170.913	14.855	-2.106	2.198	15.163
46.000	157.720	-3.088	-1.115	157.754	181.675	-3.707	-3.283	181.743	23.690	-1.112	4.061	24.061
48.000	156.096	-4.584	3.913	156.213	191.901	-4.378	0.957	191.953	35.308	-0.762	6.593	35.927
50.000	141.126	-13.942	16.832	142.808	199.739	-6.638	13.452	200.301	57.525	5.185	12.814	59.163
52.000	122.195	-24.412	32.266	128.719	206.670	-9.011	29.910	209.017	82.311	11.324	21.803	85.900
54.000	94.373	-38.752	54.224	115.535	211.079	-12.280	56.971	218.976	112.157	18.960	37.279	119.701
56.000	63.940	-52.830	78.311	114.069	213.707	-16.371	91.124	232.899	141.171	23.677	58.599	154.673
58.000	27.937	-68.681	99.258	123.894	214.085	-21.715	126.806	249.767	171.680	26.531	86.244	193.948
60.000	-48.785	-89.387	132.584	167.178	209.556	-25.937	169.668	270.875	238.362	28.911	120.368	268.591
62.000	-77.547	-101.219	145.352	193.355	203.606	-30.570	209.855	293.988	252.303	25.298	154.604	296.984
64.000	-88.016	-107.303	145.939	201.393	199.040	-34.244	238.403	312.451	249.362	19.440	183.655	310.304
66.000	-87.056	-109.586	135.436	194.758	196.297	-37.048	254.173	323.279	237.429	13.587	207.586	315.673
68.000	-81.208	-110.824	115.623	179.570	193.532	-39.896	261.153	327.486	220.628	9.256	230.063	318.891
70.000	-73.848	-112.242	90.482	161.984	189.212	-43.176	264.497	328.061	200.518	6.746	252.981	322.881
72.000	-68.106	-113.520	68.202	148.919	183.289	-46.872	268.296	328.290	181.488	4.619	273.349	328.145
74.000	-67.903	-114.780	45.146	140.795	177.090	-50.470	271.958	328.435	167.908	1.761	295.644	340.002
76.000	-74.122	-116.052	20.340	139.197	166.505	-55.141	276.103	327.105	156.313	-2.407	320.292	356.408
78.000	-83.506	-116.413	-2.649	143.291	150.797	-61.731	281.259	325.049	143.815	-8.988	343.115	372.145
80.000	-90.414	-115.111	-20.631	147.820	130.393	-69.834	287.803	323.589	126.450	-16.916	360.086	382.017

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

POINT REL. LINEAR DISPLACEMENT (IN.)

TIME	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 3 - UT IN VEH REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN VEH REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN UT REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	11.314	0.000	-26.938	29.217	7.775	0.000	-41.833	42.550	-0.022	0.000	-15.310	15.310
2.000	11.314	0.000	-26.938	29.218	7.775	0.000	-41.833	42.550	-0.022	0.000	-15.310	15.310
4.000	11.316	0.000	-26.938	29.218	7.777	0.000	-41.834	42.550	-0.022	0.000	-15.310	15.310
6.000	11.320	0.000	-26.939	29.221	7.782	0.000	-41.834	42.552	-0.023	0.000	-15.310	15.310
8.000	11.330	0.000	-26.940	29.225	7.791	0.000	-41.835	42.554	-0.023	0.000	-15.310	15.310
10.000	11.345	0.000	-26.941	29.232	7.806	0.000	-41.836	42.558	-0.022	0.000	-15.310	15.310
12.000	11.368	0.000	-26.943	29.243	7.828	0.000	-41.838	42.564	-0.022	0.000	-15.310	15.310
14.000	11.400	0.000	-26.945	29.257	7.860	0.000	-41.840	42.572	-0.021	0.000	-15.310	15.310
16.000	11.442	0.000	-26.949	29.277	7.901	0.000	-41.844	42.583	-0.020	0.001	-15.310	15.310
18.000	11.496	-0.001	-26.953	29.302	7.954	0.000	-41.848	42.597	-0.017	0.001	-15.310	15.310
20.000	11.564	-0.001	-26.958	29.334	8.021	0.000	-41.853	42.614	-0.015	0.001	-15.310	15.310
22.000	11.646	-0.001	-26.965	29.372	8.102	0.000	-41.859	42.636	-0.011	0.002	-15.310	15.310
24.000	11.745	-0.002	-26.972	29.419	8.199	0.000	-41.866	42.661	-0.005	0.004	-15.310	15.310
26.000	11.861	-0.002	-26.982	29.474	8.314	-0.001	-41.876	42.693	0.003	0.008	-15.310	15.310
28.000	11.996	-0.003	-26.994	29.539	8.447	-0.002	-41.887	42.730	0.014	0.016	-15.310	15.310
30.000	12.152	-0.003	-27.007	29.615	8.601	-0.003	-41.899	42.773	0.027	0.024	-15.310	15.310
32.000	12.330	-0.001	-27.021	29.701	8.777	-0.003	-41.913	42.822	0.044	0.032	-15.310	15.310
34.000	12.529	-0.001	-27.036	29.798	8.977	-0.004	-41.928	42.878	0.069	0.042	-15.310	15.310
36.000	12.750	-0.001	-27.050	29.905	9.200	-0.006	-41.943	42.940	0.102	0.058	-15.309	15.309
38.000	12.995	-0.003	-27.065	30.023	9.450	-0.008	-41.958	43.009	0.147	0.081	-15.308	15.309
40.000	13.262	-0.005	-27.079	30.152	9.726	-0.012	-41.973	43.085	0.206	0.112	-15.306	15.308
42.000	13.551	-0.007	-27.092	30.292	10.030	-0.016	-41.988	43.169	0.279	0.149	-15.303	15.306
44.000	13.857	-0.007	-27.104	30.441	10.360	-0.021	-42.002	43.261	0.371	0.191	-15.298	15.303
46.000	14.171	-0.011	-27.110	30.590	10.712	-0.027	-42.012	43.356	0.499	0.245	-15.288	15.298
48.000	14.486	-0.019	-27.107	30.735	11.086	-0.035	-42.014	43.452	0.659	0.307	-15.273	15.290
50.000	14.784	-0.037	-27.087	30.859	11.478	-0.046	-42.001	43.541	0.868	0.380	-15.247	15.276
52.000	15.048	-0.075	-27.039	30.944	11.884	-0.062	-41.958	43.609	1.144	0.470	-15.201	15.252
54.000	15.266	-0.138	-26.953	30.976	12.302	-0.083	-41.873	43.643	1.497	0.561	-15.128	15.212
56.000	15.424	-0.230	-26.821	30.940	12.727	-0.111	-41.726	43.624	1.939	0.645	-15.010	15.148
58.000	15.520	-0.349	-26.641	30.834	13.156	-0.149	-41.507	43.543	2.449	0.714	-14.836	15.054
60.000	15.493	-0.507	-26.412	30.624	13.579	-0.197	-41.214	43.394	2.991	0.751	-14.606	14.928
62.000	15.361	-0.699	-26.130	30.319	13.993	-0.253	-40.832	43.164	3.548	0.697	-14.323	14.772
64.000	15.193	-0.909	-25.837	29.987	14.395	-0.318	-40.382	42.872	4.108	0.585	-13.976	14.579
66.000	15.017	-1.126	-25.554	29.661	14.790	-0.390	-39.887	42.543	4.633	0.439	-13.579	14.354
68.000	14.848	-1.347	-25.302	29.368	15.180	-0.466	-39.371	42.199	5.107	0.285	-13.141	14.101
70.000	14.693	-1.569	-25.096	29.123	15.563	-0.549	-38.845	41.851	5.528	0.131	-12.660	13.815
72.000	14.552	-1.795	-24.938	28.929	15.936	-0.639	-38.313	41.500	5.887	-0.018	-12.144	13.496
74.000	14.417	-2.024	-24.824	28.778	16.297	-0.737	-37.772	41.145	6.179	-0.156	-11.604	13.147
76.000	14.275	-2.255	-24.759	28.668	16.641	-0.842	-37.225	40.784	6.409	-0.281	-11.038	12.767
78.000	14.118	-2.487	-24.742	28.595	16.959	-0.959	-36.667	40.411	6.577	-0.392	-10.451	12.355
80.000	13.944	-2.719	-24.766	28.551	17.242	-1.090	-36.098	40.019	6.684	-0.491	-9.851	11.915

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT ANGULAR ACCELERATION (REV/SEC.**2)

TIME	SEGMENT NO. 3 - UT IN UT REFERENCE				SEGMENT NO. 5 - H IN H REFERENCE				SEGMENT NO. 5 - H IN VEH REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	-0.137	0.000	0.137	0.000	-0.185	0.000	0.185	0.000	-0.185	0.000	0.185
2.000	0.001	-0.042	0.002	0.043	-0.001	-0.052	0.000	0.052	-0.001	-0.052	0.000	0.052
4.000	0.006	0.040	0.015	0.043	-0.006	-0.067	0.000	0.067	-0.006	-0.067	0.002	0.067
6.000	-0.004	0.247	0.049	0.252	0.021	-0.177	-0.001	0.178	0.020	-0.177	-0.005	0.178
8.000	-0.039	0.665	0.129	0.678	0.107	-0.365	-0.002	0.380	0.104	-0.365	-0.027	0.380
10.000	-0.080	1.188	0.277	1.223	0.221	-0.482	0.002	0.530	0.215	-0.482	-0.050	0.530
12.000	-0.118	1.611	0.416	1.669	0.332	-0.264	0.016	0.424	0.326	-0.264	-0.062	0.424
14.000	-0.083	1.943	0.457	1.997	0.283	-0.730	0.029	0.784	0.282	-0.730	-0.038	0.784
16.000	-0.087	2.460	0.635	2.542	0.302	-1.430	0.043	1.462	0.303	-1.430	-0.029	1.462
18.000	0.008	2.589	0.664	2.673	0.141	-1.610	0.060	1.617	0.151	-1.610	0.026	1.617
20.000	0.037	2.973	0.948	3.120	0.102	-2.115	0.080	2.119	0.118	-2.115	0.054	2.119
22.000	-0.010	3.607	1.429	3.879	0.244	-3.094	0.108	3.106	0.262	-3.094	0.048	3.106
24.000	-8.600	7.157	4.790	12.171	7.768	-7.307	0.183	10.666	7.598	-7.307	-1.626	10.666
26.000	-9.914	7.450	4.950	13.353	10.014	-8.144	0.309	12.911	9.812	-8.143	-2.022	12.911
28.000	-1.602	6.837	5.335	8.819	0.731	-7.928	0.450	7.974	0.814	-7.928	0.260	7.974
30.000	-2.418	7.045	5.092	9.022	-1.971	-8.546	0.594	8.791	-1.785	-8.548	1.017	8.791
32.000	-5.518	18.566	11.214	22.381	8.491	-29.792	0.788	30.988	8.434	-29.793	-1.243	30.988
34.000	-5.789	14.342	10.997	18.977	8.985	-28.116	1.107	29.537	8.988	-28.117	-1.045	29.537
36.000	-10.236	20.115	12.679	25.887	15.101	-38.011	1.455	40.927	15.018	-38.013	-2.127	40.927
38.000	-27.100	26.891	17.134	41.846	30.178	-51.830	1.903	60.006	29.806	-51.828	-5.111	60.006
40.000	-22.699	24.663	16.092	37.182	22.068	-57.722	2.414	61.843	21.998	-57.727	-2.878	61.843
42.000	-30.498	28.252	24.219	48.113	21.827	-71.925	2.986	75.223	21.854	-71.937	-2.442	75.223
44.000	-32.187	56.105	49.690	81.565	50.733	-136.186	3.903	145.381	50.213	-136.179	-8.335	145.381
46.000	-28.042	37.572	48.859	67.714	44.955	-148.639	5.635	155.391	44.854	-148.665	-5.761	155.391
48.000	-20.702	-4.036	40.577	45.731	24.155	-149.938	7.474	152.055	24.678	-150.038	-0.423	152.055
50.000	-48.385	37.032	81.432	101.704	139.703	-302.279	11.206	333.190	138.788	-302.255	-19.874	333.190
52.000	20.899	8.412	77.489	80.698	86.870	-320.679	15.481	332.598	87.017	-320.899	-8.573	332.598
54.000	21.075	54.615	169.909	179.711	120.265	-438.481	21.646	455.190	120.241	-438.852	-12.223	455.190
56.000	15.799	22.276	164.884	167.130	113.182	-428.843	29.299	444.494	113.279	-429.795	-4.359	444.494
58.000	-70.850	-73.615	-213.885	237.035	205.076	-427.001	36.749	475.117	204.444	-428.864	3.808	475.117
60.000	213.357	-282.895	320.674	477.894	-54.947	-386.329	39.469	392.209	-56.394	-388.083	-6.237	392.209
62.000	88.426	-23.362	27.240	95.430	-20.082	-300.005	42.593	303.679	-23.448	-302.770	1.119	303.679
64.000	44.445	-34.608	-63.285	84.723	-20.168	-163.484	40.696	169.676	-26.390	-167.272	10.665	169.676
66.000	-14.123	-63.981	-141.182	155.645	35.355	-125.898	37.342	135.996	24.564	-131.014	26.957	135.996
68.000	-37.438	-24.558	-71.335	84.222	82.975	-179.967	36.180	201.450	67.795	-186.059	36.984	201.450
70.000	-38.031	-65.178	-38.947	84.920	90.968	-166.521	37.777	193.473	68.935	-174.339	47.809	193.473
72.000	-58.153	-115.779	-40.978	135.889	65.468	-76.947	39.363	108.427	34.892	-86.935	54.600	108.427
74.000	-73.956	-128.701	-33.634	152.200	71.790	-104.065	35.913	131.427	39.042	-114.114	52.218	131.427
76.000	-108.913	-153.734	-12.238	188.802	85.877	-134.273	35.927	163.386	46.823	-145.589	57.501	163.386
78.000	-133.289	-152.796	3.154	202.787	80.966	-120.334	37.667	149.849	34.375	-133.462	58.829	149.849
80.000	-132.606	-117.860	3.936	177.457	51.234	-55.968	40.143	85.842	-0.345	-70.727	48.645	85.842

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT REL. ANGULAR VELOCITY (REV/SEC.)

TIME	SEGMENT NO. 3 - UT IN VEH REFERENCE				SEGMENT NO. 5 - H IN VEH REFERENCE				SEGMENT NO. 5 - H IN H REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.001	0.000	-0.001	0.000	0.001
8.000	0.000	0.001	0.000	0.001	0.000	-0.001	0.000	0.001	0.000	-0.001	0.000	0.001
10.000	0.000	0.003	0.001	0.003	0.001	-0.002	0.000	0.002	0.001	-0.002	0.000	0.002
12.000	0.000	0.006	0.002	0.006	0.001	-0.003	0.000	0.003	0.001	-0.003	0.000	0.003
14.000	0.000	0.009	0.003	0.010	0.002	-0.004	0.000	0.004	0.002	-0.004	0.000	0.004
16.000	0.000	0.014	0.004	0.014	0.002	-0.006	0.000	0.006	0.002	-0.006	0.000	0.006
18.000	0.000	0.019	0.005	0.019	0.003	-0.009	0.000	0.009	0.003	-0.009	0.000	0.009
20.000	0.000	0.024	0.006	0.025	0.004	-0.013	0.000	0.013	004	-0.013	0.000	0.013
22.000	0.001	0.031	0.009	0.032	0.005	-0.018	-0.001	0.019	.05	-0.018	0.001	0.019
24.000	-0.012	0.044	0.021	0.050	0.016	-0.031	-0.003	0.035	0.017	-0.031	0.001	0.035
26.000	-0.026	0.058	0.033	0.072	0.033	-0.046	-0.007	0.057	0.034	-0.046	0.001	0.057
28.000	-0.036	0.072	0.046	0.093	0.046	-0.062	-0.009	0.077	0.047	-0.062	0.002	0.077
30.000	-0.036	0.085	0.055	0.108	0.044	-0.078	-0.007	0.089	0.044	-0.078	0.003	0.089
32.000	-0.037	0.112	0.075	0.139	0.045	-0.114	-0.006	0.123	0.045	-0.114	0.004	0.123
34.000	-0.049	0.146	0.102	0.185	0.067	-0.174	-0.010	0.187	0.067	-0.174	0.006	0.187
36.000	-0.076	0.180	0.132	0.236	0.105	-0.236	-0.016	0.258	0.106	-0.236	0.009	0.258
38.000	-0.114	0.231	0.174	0.311	0.158	-0.331	-0.025	0.367	0.159	-0.331	0.012	0.367
40.000	-0.139	0.277	0.212	0.376	0.200	-0.436	-0.031	0.481	0.202	-0.436	0.017	0.481
42.000	-0.172	0.326	0.260	0.452	0.239	-0.565	-0.035	0.614	0.240	-0.565	0.022	0.614
44.000	-0.196	0.409	0.348	0.571	0.285	-0.766	-0.041	0.818	0.287	-0.766	0.029	0.818
46.000	-0.235	0.504	0.469	0.728	0.385	-1.056	-0.056	1.125	0.388	-1.056	0.038	1.125
48.000	-0.229	0.530	0.567	0.809	0.447	-1.355	-0.060	1.428	0.449	-1.355	0.051	1.428
50.000	-0.241	0.669	0.811	1.079	0.652	-1.933	-0.092	2.042	0.655	-1.933	0.069	2.042
52.000	-0.192	0.728	0.993	1.246	0.850	-2.558	-0.116	2.698	0.854	-2.558	0.096	2.698
54.000	-0.059	0.902	1.343	1.618	1.071	-3.411	-0.144	3.578	1.075	-3.411	0.132	3.578
56.000	0.073	1.021	1.706	1.989	1.296	-4.299	-0.161	4.493	1.300	-4.297	0.183	4.493
58.000	0.050	0.985	1.756	2.014	1.581	-5.149	-0.162	5.389	1.586	-5.144	0.249	5.389
60.000	0.638	0.350	2.155	2.274	1.585	-6.117	-0.179	6.321	1.591	-6.109	0.325	6.321
62.000	0.889	0.383	2.284	2.480	1.553	-6.864	-0.186	7.040	1.563	-6.852	0.408	7.040
64.000	0.999	0.342	2.217	2.456	1.491	-7.290	-0.171	7.443	1.512	-7.271	0.492	7.443
66.000	0.984	0.240	2.039	2.276	1.477	-7.552	-0.134	7.696	1.514	-7.524	0.570	7.696
68.000	0.901	0.147	1.885	2.095	1.563	-7.860	-0.072	8.014	1.626	-7.821	0.642	8.014
70.000	0.823	0.060	1.817	1.996	1.708	-8.236	0.012	8.412	1.807	-8.184	0.716	8.412
72.000	0.766	-0.148	1.772	1.936	1.824	-8.529	0.116	8.722	1.975	-8.458	0.794	8.722
74.000	0.692	-0.414	1.729	1.908	1.879	-8.677	0.222	8.881	2.095	-8.586	0.868	8.881
76.000	0.606	-0.733	1.717	1.963	1.971	-8.960	0.328	9.180	2.256	-8.849	0.939	9.180
78.000	0.491	-1.104	1.763	2.138	2.058	-9.256	0.445	9.492	2.428	-9.120	1.013	9.492
80.000	0.353	-1.429	1.829	2.347	2.089	-9.448	0.553	9.692	2.557	-9.285	1.090	9.692

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT REL. ANGULAR DISPLACEMENT (DEG)

TIME	SEGMENT NO. 3 - UT IN VEH REFERENCE				SEGMENT NO. 5 - H IN VEH REFERENCE				SEGMENT NO. 5 - H IN UT REFERENCE			
(MSEC)	YAW	PITCH	ROLL	RES	YAW	PITCH	ROLL	RES	YAW	PITCH	ROLL	RES
0.000	0.000	13.280	0.000	13.280	0.000	13.460	0.000	13.460	0.000	0.180	0.000	0.180
2.000	0.000	13.280	0.000	13.280	0.000	13.460	0.000	13.460	0.000	0.180	0.000	0.180
4.000	0.000	13.280	0.000	13.280	0.000	13.460	0.000	13.460	0.000	0.180	0.000	0.180
6.000	0.000	13.280	0.000	13.280	0.000	13.459	0.000	13.459	0.000	0.180	0.000	0.180
8.000	0.000	13.280	0.000	13.280	0.000	13.459	0.000	13.459	0.000	0.179	0.000	0.179
10.000	0.001	13.281	0.000	13.281	0.000	13.458	0.000	13.458	-0.001	0.176	0.000	0.176
12.000	0.001	13.284	0.000	13.284	0.000	13.456	0.001	13.456	-0.001	0.171	0.001	0.172
14.000	0.003	13.290	0.000	13.290	0.000	13.454	0.002	13.454	-0.003	0.164	0.003	0.164
16.000	0.005	13.298	0.000	13.298	0.000	13.450	0.003	13.450	-0.005	0.152	0.005	0.152
18.000	0.008	13.310	0.000	13.310	0.000	13.445	0.005	13.445	-0.008	0.135	0.007	0.136
20.000	0.012	13.325	0.000	13.325	0.000	13.437	0.008	13.437	-0.011	0.112	0.010	0.113
22.000	0.018	13.345	0.001	13.345	0.001	13.426	0.011	13.426	-0.016	0.081	0.014	0.084
24.000	0.027	13.372	-0.003	13.372	0.001	13.409	0.018	13.409	-0.025	0.037	0.027	0.052
26.000	0.043	13.409	-0.017	13.409	0.002	13.381	0.036	13.382	-0.040	-0.027	0.063	0.079
28.000	0.067	13.456	-0.042	13.456	0.003	13.343	0.067	13.343	-0.062	-0.113	0.124	0.179
30.000	0.097	13.513	-0.069	13.513	0.005	13.293	0.101	13.293	-0.089	-0.220	0.191	0.305
32.000	0.136	13.582	-0.095	13.583	0.008	13.227	0.132	13.228	-0.126	-0.354	0.257	0.455
34.000	0.193	13.675	-0.127	13.677	0.011	13.123	0.173	13.124	-0.178	-0.552	0.343	0.673
36.000	0.265	13.791	-0.175	13.795	0.017	12.978	0.237	12.980	-0.245	-0.813	0.471	0.970
38.000	0.359	13.939	-0.243	13.946	0.023	12.775	0.333	12.779	-0.332	-1.162	0.657	1.374
40.000	0.476	14.123	-0.336	14.136	0.032	12.500	0.466	12.508	-0.443	-1.620	0.910	1.907
42.000	0.617	14.341	-0.449	14.354	0.042	12.140	0.628	12.156	-0.579	-2.196	1.220	2.572
44.000	0.797	14.601	-0.582	14.638	0.055	11.672	0.813	11.700	-0.757	-2.920	1.583	3.398
46.000	1.052	14.935	-0.739	14.997	0.068	11.017	1.061	11.067	-1.018	-3.903	2.055	4.511
48.000	1.383	15.315	-0.905	15.414	0.082	10.149	1.367	10.240	-1.367	-5.141	2.620	5.902
50.000	1.837	15.754	-1.063	15.912	0.093	8.975	1.755	9.144	-1.860	-6.738	3.301	7.683
52.000	2.445	16.263	-1.213	16.515	0.095	7.361	2.304	7.712	-2.548	-8.837	4.197	10.024
54.000	3.262	16.853	-1.279	17.247	0.077	5.221	2.994	6.017	-3.499	-11.531	5.240	12.994
56.000	4.376	17.548	-1.225	18.167	0.024	2.443	3.846	4.556	-4.830	-14.954	6.468	16.740
58.000	5.730	18.282	-1.076	19.232	-0.080	-0.956	4.867	4.960	-6.520	-19.021	7.925	21.188
60.000	7.198	18.725	-0.796	20.112	-0.263	-5.032	6.043	7.858	-8.457	-23.473	9.510	26.030
62.000	9.010	18.894	-0.167	20.927	-0.545	-9.713	7.216	12.079	-10.799	-28.287	10.903	31.183
64.000	10.867	19.035	0.596	21.863	-0.927	-14.811	8.405	16.984	-13.329	-33.526	12.297	36.700
66.000	12.684	19.097	1.389	22.806	-1.407	-20.134	9.632	22.235	-15.925	-38.944	13.770	42.339
68.000	14.326	19.070	2.120	23.692	-2.012	-25.641	10.994	27.755	-18.620	-44.470	15.523	48.056
70.000	15.868	18.985	2.772	24.554	-2.808	-31.383	12.610	33.588	-21.668	-50.163	17.827	53.960
72.000	17.346	18.800	3.344	25.369	-3.876	-37.343	14.579	39.712	-25.358	-55.941	20.942	60.003
74.000	18.753	18.447	3.806	26.080	-5.305	-43.404	16.970	46.004	-30.054	-61.584	25.198	66.009
76.000	20.091	17.906	4.127	26.679	-7.292	-49.559	19.979	52.473	-36.534	-66.989	31.360	71.966
78.000	21.384	17.148	4.271	27.175	-10.213	-55.825	23.994	59.178	-46.425	-71.980	41.030	77.911
80.000	22.660	16.188	4.207	27.614	-14.704	-62.089	29.648	66.073	-62.537	-76.081	56.973	83.815

DATE:	2 SEPT 1988	
RUN DESCRIPTION:	EXAMPLE 1: BASIC SLED TEST SIMULATION	
	TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD	PAGE: 27.01
VEHICLE DECELERATION:	SLED ACCELERATION - 20G PEAK	
CRASH VICTIM:	95TH PERCENTILE MALE	

JOINT PARAMETERS

		JOINT NO. 3 - NP						JOINT NO. 4 - HP							
TIME	STATE	JOINT ANGLES (DEG)			TOTAL TORQUE (IN. LB.)			STATE	JOINT ANGLES (DEG)			TOTAL TORQUE (IN. LB.)			
(MSEC)	IPIN	FLEXURE	AZIMUTH	TORSION	SPRING	VISCOUS	RES.	IPIN	FLEXURE	AZIMUTH	TORSION	SPRING	VISCOUS	RES.	
0.000	0.	10.180	0.000	0.000	0.000	0.000	0.000	0.	10.000	0.000	0.000	0.000	0.000	0.000	
2.000	0.	10.181	0.000	0.000	0.000	0.118	0.118	0.	9.999	0.000	0.000	0.000	0.118	0.118	
4.000	0.	10.184	0.000	0.000	0.000	0.190	0.190	0.	9.996	0.000	0.000	0.000	0.194	0.194	
6.000	0.	10.189	0.000	0.000	0.000	0.241	0.241	0.	9.991	0.000	0.000	0.000	0.263	0.263	
8.000	0.	10.194	-0.001	0.000	0.000	0.224	0.224	0.	9.985	0.001	0.000	0.000	0.303	0.303	
10.000	0.	10.197	-0.005	0.000	0.000	0.115	0.115	0.	9.979	0.002	0.000	0.000	0.284	0.284	
12.000	0.	10.197	-0.013	-0.001	0.000	0.166	0.166	0.	9.974	0.005	0.000	0.000	0.187	0.187	
14.000	0.	10.192	-0.026	-0.002	0.000	0.401	0.401	0.	9.971	0.009	-0.001	0.000	0.112	0.112	
16.000	0.	10.182	-0.042	-0.003	0.000	0.680	0.680	0.	9.970	0.012	-0.002	0.000	0.069	0.069	
18.000	0.	10.166	-0.061	-0.004	0.000	0.977	0.977	0.	9.969	0.013	-0.003	0.000	0.072	0.072	
20.000	0.	10.144	-0.081	-0.006	0.000	1.281	1.281	0.	9.968	0.012	-0.004	0.000	0.104	0.104	
22.000	0.	10.115	-0.104	-0.009	0.000	1.728	1.728	0.	9.967	0.009	-0.006	0.000	0.122	0.122	
24.000	0.	10.068	-0.222	-0.013	0.000	3.586	3.586	0.	9.970	0.046	-0.009	0.000	0.771	0.771	
26.000	0.	9.997	-0.530	-0.019	0.000	5.256	5.256	0.	9.977	0.134	-0.016	0.000	0.981	0.981	
28.000	0.	9.907	-0.984	-0.026	0.000	6.009	6.009	0.	9.981	0.211	-0.024	0.000	0.458	0.458	
30.000	0.	9.805	-1.332	-0.039	0.000	6.012	6.012	0.	9.978	0.136	-0.034	0.000	1.331	1.331	
32.000	0.	9.671	-1.592	-0.058	0.000	9.657	9.657	0.	9.978	-0.039	-0.045	0.000	1.704	1.704	
34.000	0.	9.440	-2.129	-0.084	0.000	14.463	14.463	0.	10.014	-0.105	-0.062	0.000	2.267	2.267	
36.000	0.	9.152	-3.083	-0.113	0.000	18.782	18.782	0.	10.046	-0.075	-0.088	0.000	2.371	2.371	
38.000	0.	8.767	-4.576	-0.147	0.000	26.352	26.352	0.	10.095	-0.005	-0.122	0.000	3.606	3.606	
40.000	0.	8.280	-6.692	-0.188	0.000	31.362	31.362	0.	10.149	0.007	-0.163	0.000	3.348	3.348	
42.000	0.	7.699	-9.366	-0.240	0.000	37.757	37.757	0.	10.197	-0.171	-0.212	0.000	4.202	4.202	
44.000	0.	6.972	-12.870	-0.317	0.000	52.652	52.652	0.	10.265	-0.573	-0.269	0.000	7.887	7.887	
46.000	0.	5.966	-19.595	-0.430	0.000	71.325	71.325	0.	10.445	-0.726	-0.352	0.000	11.132	11.132	
48.000	0.	4.869	-30.859	-0.581	0.000	80.360	80.360	0.	10.627	-1.060	-0.464	0.000	10.999	10.999	
50.000	0.	3.822	-54.577	-0.804	0.000	125.388	125.388	0.	10.957	-1.213	-0.617	0.000	25.143	25.143	
52.000	0.	4.001	-95.947	-1.088	0.000	150.487	150.487	0.	11.421	-0.891	-0.839	0.000	25.934	25.934	
54.000	0.	6.124	-127.683	-1.502	0.000	193.882	193.882	0.	11.949	-0.784	-1.122	0.000	32.618	32.618	
56.000	0.	9.668	-143.883	-2.084	0.000	220.529	220.529	0.	12.423	-0.721	-1.497	0.000	27.056	27.056	
58.000	0.	13.878	-152.083	-2.748	0.000	235.094	235.094	0.	12.563	-0.690	-1.964	0.000	26.095	26.095	
60.000	0.	18.379	-157.625	-3.482	0.000	234.042	234.042	0.	12.544	-1.090	-2.446	0.000	28.518	28.518	
62.000	0.	22.709	-162.883	-4.505	0.000	238.449	238.449	0.	12.127	-2.354	-2.954	0.000	43.769	43.769	
64.000	0.	26.899	-167.023	-5.484	18.036	216.552	233.247	0.	11.096	-3.358	-3.457	0.000	73.428	73.428	
66.000	0.	30.558	-170.082	-6.297	154.456	176.484	324.673	0.	9.293	-4.188	-3.894	0.000	115.796	115.796	
68.000	0.	33.331	-172.228	-6.882	347.062	123.565	462.542	0.	6.439	-6.114	-4.250	0.000	175.281	175.281	
70.000	0.	35.027	-173.783	-7.296	502.714	67.615	559.233	0.	2.361	-19.607	-4.534	0.000	244.357	244.357	
72.000	0.	35.552	-174.978	-7.592	493.636	30.690	494.729	0.	3.448	-162.475	-4.760	0.000	303.225	303.225	
74.000	0.	35.540	-17[illegible].910	-7.807	466.062	24.286	466.652	0.	9.415	-172.198	-4.909	0.000	300.392	300.392	
76.000	0.	35.544	-1[illegible].681	-7.960	539.761	20.915	540.627	0.	15.394	-174.585	-4.988	0.000	299.780	299.780	
78.000	0.	35.568	-177.364	-8.079	558.450	19.211	561.920	0.	21.358	-175.662	-5.027	0.000	295.975	295.975	
80.000	0.	35.764	-178.027	-8.198	579.271	26.658	596.493	0.	27.109	-176.275	-5.046	22.243	278.693	300.921	

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

HP JOINT FORCES & TORQUES ON H IN H REFERENCE

TIME (MSEC)	JOINT FORCE (LB. 10**2) X	Y	Z	JOINT TORQUE (IN.- LB. 10**2) X	Y	Z
0.000	0.000	0.000	-0.126	0.000E+00	0.000E+00	0.000E+00
2.000	0.000	0.000	-0.129	-0.119E-06	0.118E-02	0.232E-07
4.000	0.001	0.000	-0.136	-0.939E-07	0.194E-02	0.765E-06
6.000	0.002	0.000	-0.142	0.273E-04	0.263E-02	0.587E-05
8.000	0.002	0.000	-0.148	0.116E-03	0.303E-02	0.258E-04
10.000	0.001	-0.001	-0.158	0.238E-03	0.283E-02	0.725E-04
12.000	-0.001	-0.001	-0.171	0.385E-03	0.183E-02	0.160E-03
14.000	-0.003	-0.001	-0.181	0.383E-03	0.101E-02	0.284E-03
16.000	-0.005	-0.001	-0.190	0.297E-03	0.458E-03	0.427E-03
18.000	-0.005	0.000	-0.202	0.148E-03	0.370E-03	0.601E-03
20.000	-0.007	0.000	-0.210	0.503E-05	0.665E-03	0.800E-03
22.000	-0.010	-0.001	-0.218	0.670E-04	0.574E-03	0.107E-02
24.000	-0.024	-0.021	-0.273	0.675E-02	-0.325E-02	0.181E-02
26.000	-0.027	-0.028	-0.270	0.883E-02	-0.301E-02	0.305E-02
28.000	-0.026	-0.002	-0.254	0.106E-02	-0.444E-03	0.444E-02
30.000	-0.029	0.004	-0.263	-0.115E-01	0.330E-02	0.586E-02
32.000	-0.097	-0.027	-0.164	-0.105E-01	-0.109E-01	0.776E-02
34.000	-0.090	-0.026	-0.153	-0.180E-02	-0.198E-01	0.108E-01
36.000	-0.123	-0.043	-0.131	0.560E-02	-0.182E-01	0.141E-01
38.000	-0.167	-0.086	-0.217	0.121E-01	-0.287E-01	0.182E-01
40.000	-0.187	-0.065	-0.200	-0.435E-02	-0.242E-01	0.227E-01
42.000	-0.235	-0.067	-0.280	-0.207E-01	-0.239E-01	0.277E-01
44.000	-0.440	-0.151	0.231	-0.200E-01	-0.675E-01	0.356E-01
46.000	-0.476	-0.133	0.180	-0.666E-02	-0.992E-01	0.500E-01
48.000	-0.484	-0.078	0.423	-0.409E-01	-0.785E-01	0.653E-01
50.000	-0.964	-0.400	1.929	0.475E-01	-0.229E+00	0.927E-01
52.000	-1.025	-0.250	2.650	0.333E-01	-0.227E+00	0.122E+00
54.000	-1.406	-0.348	4.626	0.417E-01	-0.281E+00	0.161E+00
56.000	-1.393	-0.331	5.514	0.379E-01	-0.168E+00	0.208E+00
58.000	-1.416	-0.595	5.141	0.910E-01	0.106E-01	0.244E+00
60.000	-1.296	0.123	7.496	-0.979E-01	0.101E+00	0.248E+00
62.000	-1.049	0.016	5.739	-0.807E-01	0.339E+00	0.264E+00
64.000	-0.656	0.016	3.853	-0.406E-01	0.692E+00	0.241E+00
66.000	-0.606	-0.153	1.823	-0.400E-01	0.114E+01	0.202E+00
68.000	-0.887	-0.314	1.048	-0.123E+00	0.174E+01	0.171E+00
70.000	-0.958	-0.369	1.210	-0.259E+00	0.242E+01	0.156E+00
72.000	-0.758	-0.324	1.329	-0.380E+00	0.300E+01	0.143E+00
74.000	-0.842	-0.344	1.491	-0.344E+00	0.298E+01	0.897E-01
76.000	-0.939	-0.393	2.383	-0.340E+00	0.298E+01	0.605E-01
78.000	-0.884	-0.387	3.033	-0.337E+00	0.294E+01	0.453E-01
80.000	-0.676	-0.312	3.738	-0.352E+00	0.299E+01	0.461E-01

DATE: 2 SEPT 1988

RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION

TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK

CRASH VICTIM: 95TH PERCENTILE MALE

BODY PROPERTIES - REFERENCE SEGMENT NO. 16 (VEH)

INCLUDED SEGMENT NOS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

TIME	CENTER OF GRAVITY (IN.)			LINEAR MOMENTUM (LB.-SEC.)			ANGULAR MOMENTUM (IN.- LB.-SEC.)			KINETIC ENERGY (LB.- IN.)		
(MSEC)	X	Y	Z	X	Y	Z	X	Y	Z	LINEAR	ANGULAR	TOTAL
0.000	18.183	0.000	-20.231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2.000	18.183	0.000	-20.231	-0.252E-01	0.287E-06	0.723E-04	-0.699E-04	0.197E-01	0.304E-03	0.382E-01	0.495E-02	0.431E-01
4.000	18.185	0.000	-20.231	-0.121E+00	-0.220E-04	-0.665E-02	-0.641E-03	0.993E+00	0.158E-02	0.505E+00	0.344E-01	0.539E+00
6.000	18.189	0.000	-20.231	-0.299E+00	-0.442E-03	-0.326E-01	-0.121E-01	0.341E+01	0.154E-02	0.242E+01	0.137E+00	0.256E+01
8.000	18.197	0.000	-20.231	-0.543E+00	-0.201E-02	-0.842E-01	-0.554E-01	0.730E+01	-0.472E-02	0.754E+01	0.391E+00	0.793E+01
10.000	18.210	0.000	-20.232	-0.841E+00	-0.497E-02	-0.167E+00	-0.138E+00	0.127E+02	-0.181E-01	0.184E+02	0.862E+00	0.192E+02
12.000	18.230	0.000	-20.233	-0.118E+01	-0.991E-02	-0.283E+00	-0.275E+00	0.194E+02	-0.448E-01	0.384E+02	0.155E+01	0.399E+02
14.000	18.257	0.000	-20.234	-0.155E+01	-0.150E-01	-0.435E+00	-0.416E+00	0.274E+02	-0.749E-01	0.717E+02	0.247E+01	0.742E+02
16.000	18.294	0.000	-20.236	-0.195E+01	-0.197E-01	-0.622E+00	-0.546E+00	0.366E+02	-0.995E-01	0.123E+03	0.365E+01	0.127E+03
18.000	18.342	0.000	-20.239	-0.239E+01	-0.243E-01	-0.844E+00	-0.671E+00	0.469E+02	-0.121E+00	0.200E+03	0.515E+01	0.205E+03
20.000	18.402	0.000	-20.242	-0.287E+01	-0.286E-01	-0.110E+01	-0.789E+00	0.584E+02	-0.134E+00	0.307E+03	0.698E+01	0.314E+03
22.000	18.476	0.000	-20.247	-0.340E+01	-0.356E-01	-0.140E+01	-0.982E+00	0.713E+02	-0.157E+00	0.451E+03	0.923E+01	0.461E+03
24.000	18.564	-0.001	-20.253	-0.401E+01	-0.350E-01	-0.183E+01	-0.164E+01	0.880E+02	0.204E+00	0.641E+03	0.118E+02	0.653E+03
26.000	18.669	-0.001	-20.260	-0.463E+01	-0.365E-01	-0.227E+01	-0.252E+01	0.105E+03	0.607E+00	0.886E+03	0.146E+02	0.901E+03
28.000	18.792	-0.001	-20.270	-0.528E+01	-0.204E-02	-0.270E+01	-0.226E+01	0.122E+03	0.141E+01	0.120E+04	0.179E+02	0.122E+04
30.000	18.933	-0.001	-20.280	-0.598E+01	0.973E-01	-0.311E+01	0.463E+00	0.139E+03	0.286E+01	0.158E+04	0.216E+02	0.160E+04
32.000	19.095	0.000	-20.292	-0.691E+01	0.132E+00	-0.341E+01	0.168E+01	0.160E+03	0.401E+01	0.204E+04	0.264E+02	0.206E+04
34.000	19.278	0.000	-20.306	-0.820E+01	0.583E-01	0.369E+01	-0.240E+00	0.189E+03	0.455E+01	0.256E+04	0.343E+02	0.259E+04
36.000	19.481	0.000	-20.320	-0.988E+01	0.265E-01	-0.410E+01	-0.155E+01	0.226E+03	0.628E+01	0.315E+04	0.483E+02	0.320E+04
38.000	19.704	0.001	-20.336	-0.122E+02	0.801E-01	-0.454E+01	-0.166E+01	0.277E+03	0.101E+02	0.379E+04	0.721E+02	0.386E+04
40.000	19.948	0.001	-20.354	-0.149E+02	0.324E+00	-0.494E+01	0.272E+01	0.333E+03	0.171E+02	0.449E+04	0.104E+03	0.460E+04
42.000	20.212	0.003	-20.373	-0.180E+02	0.767E+00	-0.541E+01	0.108E+02	0.400E+03	0.278E+02	0.520E+04	0.136E+03	0.533E+04
44.000	20.492	0.007	-20.393	-0.220E+02	0.103E+01	-0.537E+01	0.138E+02	0.483E+03	0.377E+02	0.576E+04	0.166E+03	0.593E+04
46.000	20.782	0.010	-20.412	-0.272E+02	0.825E+00	-0.462E+01	0.280E+01	0.583E+03	0.427E+02	0.611E+04	0.192E+03	0.631E+04
48.000	21.078	0.014	-20.426	-0.336E+02	0.103E+01	-0.313E+01	-0.118E+01	0.699E+03	0.510E+02	0.623E+04	0.206E+03	0.644E+04
50.000	21.369	0.015	-20.431	-0.431E+02	-0.477E+00	0.120E+01	-0.558E+02	0.860E+03	0.409E+02	0.588E+04	0.251E+03	0.614E+04
52.000	21.644	0.010	-20.416	-0.545E+02	-0.246E+01	0.687E+01	-0.122E+03	0.104E+04	0.198E+02	0.539E+04	0.363E+03	0.575E+04
54.000	21.894	-0.005	-20.377	-0.685E+02	-0.545E+01	0.145E+02	-0.211E+03	0.126E+04	-0.927E+01	0.491E+04	0.673E+03	0.558E+04
56.000	22.111	-0.030	-20.309	-0.834E+02	-0.852E+01	0.220E+02	-0.295E+03	0.151E+04	-0.346E+02	0.471E+04	0.104E+04	0.574E+04
58.000	22.290	-0.069	-20.216	-0.991E+02	-0.135E+02	0.279E+02	-0.411E+03	0.179E+04	-0.797E+02	0.476E+04	0.128E+04	0.604E+04
60.000	22.406	-0.126	-20.096	-0.125E+03	-0.182E+02	0.375E+02	-0.524E+03	0.227E+04	-0.120E+03	0.581E+04	0.201E+04	0.782E+04
62.000	22.463	-0.202	-19.952	-0.140E+03	-0.221E+02	0.392E+02	-0.608E+03	0.259E+04	-0.146E+03	0.655E+04	0.226E+04	0.881E+04
64.000	22.487	-0.287	-19.810	-0.150E+03	-0.237E+02	0.370E+02	-0.647E+03	0.284E+04	-0.148E+03	0.673E+04	0.223E+04	0.896E+04
66.000	22.490	-0.376	-19.683	-0.158E+03	-0.241E+02	0.311E+02	-0.659E+03	0.306E+04	-0.145E+03	0.640E+04	0.206E+04	0.846E+04
68.000	22.476	-0.465	-19.584	-0.166E+03	-0.239E+02	0.220E+02	-0.658E+03	0.329E+04	-0.144E+03	0.579E+04	0.189E+04	0.768E+04
70.000	22.446	-0.552	-19.523	-0.171E+03	-0.235E+02	0.114E+02	-0.651E+03	0.348E+04	-0.141E+03	0.524E+04	0.177E+04	0.700E+04
72.000	22.406	-0.640	-19.495	-0.175E+03	-0.237E+02	0.416E+01	-0.648E+03	0.360E+04	-0.142E+03	0.484E+04	0.164E+04	0.648E+04
74.000	22.358	-0.728	-19.490	-0.180E+03	-0.238E+02	-0.130E+01	-0.646E+03	0.369E+04	-0.147E+03	0.453E+04	0.150E+04	0.604E+04
76.000	22.298	-0.816	-19.505	-0.183E+03	-0.240E+02	-0.635E+01	-0.648E+03	0.377E+04	-0.156E+03	0.443E+04	0.143E+04	0.587E+04
78.000	22.233	-0.905	-19.537	-0.185E+03	-0.242E+02	-0.114E+02	-0.655E+03	0.383E+04	-0.166E+03	0.456E+04	0.146E+04	0.602E+04
80.000	22.165	-0.995	-19.588	-0.186E+03	-0.244E+02	-0.161E+02	-0.659E+03	0.386E+04	-0.170E+03	0.477E+04	0.155E+04	0.632E+04

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 1 (SEAT. 6 DEGREE OFF H) VS. SEGMENT 1 (LT)							PANEL 1 (SEAT. 6 DEGREE OFF H) VS. SEGMENT 6 (RUL)						
	DEFL-	NORMAL	FRICTION	RESULTANT	CONTACT LOCATION (IN.)			DEFL-	NORMAL	FRICTION	RESULTANT	CONTACT LOCATION (IN.)		
TIME	ECTION	FORCE	FORCE	FORCE	(VEH REFERENCE)			ECTION	FORCE	FORCE	FORCE	(VEH REFERENCE)		
(MSEC)	(IN.)	(LB.)	(LB.)	(LB.)	X	Y	Z	(IN.)	(LB.)	(LB.)	(LB.)	X	Y	Z
0.000	0.458	137.10	0.00	137.10	14.372	0.000	-10.459	0.250	29.94	0.00	29.94	24.725	3.420	-11.545
2.000	0.458	137.02	8.94	137.31	14.373	0.000	-10.459	0.250	31.22	4.99	31.62	24.725	3.420	-11.545
4.000	0.458	136.86	27.51	139.60	14.375	0.000	-10.459	0.250	36.69	15.37	39.79	24.726	3.420	-11.545
6.000	0.458	136.72	46.60	144.44	14.380	0.000	-10.460	0.250	44.22	22.11	49.44	24.727	3.420	-11.545
8.000	0.457	138.78	64.83	153.18	14.390	0.000	-10.461	0.251	51.70	25.85	57.80	24.729	3.420	-11.546
10.000	0.458	144.58	72.29	161.65	14.407	0.000	-10.462	0.251	58 35	29.18	65.24	24.732	3.420	-11.546
12.000	0.458	152.48	76.24	170.48	14.431	0.000	-10.465	0.252	63.83	31.91	71.36	24.737	3.420	-11.546
14.000	0.458	161.71	80.85	180.80	14.464	0.000	-10.468	0.253	68.37	34.18	76.44	24.744	3.420	-11.547
16.000	0.459	172.39	86.19	192.73	14.508	0.000	-10.473	0.254	72.13	36.06	80.64	24.755	3.420	-11.548
18.000	0.459	184.02	92.01	205.74	14.565	-0.001	-10.479	0.255	75.12	37.56	83.99	24.770	3.420	-11.550
20.000	0.460	196.74	98.37	219.96	14.635	-0.001	-10.486	0.256	76.24	38.12	85.24	24.790	3.420	-11.552
22.000	0.461	211.45	105.72	236.41	14.720	-0.001	-10.495	0.257	74.47	37.23	83.26	24.816	3.420	-11.555
24.000	0.463	200.50	100.25	224.17	14.822	-0.001	-10.506	0.257	66.45	33.22	74.29	24.849	3.420	-11.558
26.000	0.464	199.45	99.72	222.99	14.942	-0.001	-10.519	0.257	58.64	29.32	65.56	24.891	3.420	-11.563
28.000	0.465	207.89	103.94	232.42	15.081	0.000	-10.533	0.256	49.90	24.95	55.79	24.942	3.420	-11.568
30.000	0.466	228.27	114.13	255.21	15.242	0.001	-10.550	0.255	45.48	22.74	50.85	25.002	3.420	-11.574
32.000	0.468	279.53	139.76	312.52	15.424	0.006	-10.569	0.253	53.74	26.87	60.08	25.069	3.421	-11.581
34.000	0.472	356.68	178.34	398.78	15.630	0.016	-10.591	0.251	53.97	26.99	60.35	25.138	3.421	-11.589
36.000	0.478	448.62	224.31	501.57	15.859	0.038	-10.615	0.248	38.40	19.20	42.93	25.207	3.421	-11.596
38.000	0.485	560.72	280.36	626.90	16.111	0.079	-10.641	0.244	37.83	18.91	42.29	25.272	3.422	-11.603
40.000	0.496	634.27	317.14	709.14	16.385	0.146	-10.670	0.239	65.17	32.59	72.87	25.325	3.424	-11.608
42.000	0.510	664.96	332.48	743.44	16.679	0.237	-10.701	0.234	89.40	44.70	99.96	25.364	3.428	-11.612
44.000	0.527	703.41	351.70	786.43	16.985	0.346	-10.733	0.230	119.38	59.69	133.47	25.391	3.434	-11.615
46.000	0.551	756.42	378.21	845.71	17.293	0.460	-10.765	0.227	157.62	78.81	176.23	25.402	3.441	-11.616
48.000	0.585	828.62	414.31	926.43	17.592	0.567	-10.797	0.225	201.14	100.57	224.88	25.394	3.451	-11.615
50.000	0.634	922.91	461.45	1031.84	17.867	0.638	-10.826	0.225	230.71	115.35	257.94	25.366	3.464	-11.613
52.000	0.705	1043.08	521.54	1166.20	18.102	0.630	-10.850	0.225	229.76	114.88	256.88	25.326	3.480	-11.608
54.000	0.806	1090.42	545.21	1219.13	18.285	0.526	-10.869	0.227	275.31	137.65	307.80	25.267	3.497	-11.602
56.000	0.942	1085.51	542.75	1213.64	18.410	0.360	-10.883	0.237	287.36	143.68	321.28	25.149	3.514	-11.590
58.000	1.113	1255.01	627.50	1403.14	18.483	0.194	-10.890	0.263	319.11	159.55	356.77	24.927	3.526	-11.567
60.000	1.323	1450.74	725.37	1621.98	18.497	0.037	-10.892	0.312	369.55	184.78	413.17	24.589	3.526	-11.531
62.000	1.576	1827.33	913.67	2043.02	18.468	-0.132	-10.889	0.373	440.16	220.08	492.11	24.222	3.511	-11.493
64.000	1.825	2293.38	1146.69	2564.07	18.450	-0.237	-10.887	0.443	571.58	285.79	639.04	23.850	3.487	-11.453
66.000	2.046	2723.02	1361.51	3044.43	18.439	-0.287	-10.886	0.512	745.66	372.83	833.68	23.509	3.460	-11.418
68.000	2.217	3434.09	1717.05	3839.43	18.418	-0.298	-10.883	0.565	895.39	447.69	1001.07	23.230	3.435	-11.388
70.000	2.318	3801.87	1900.93	4250.62	18.370	-0.288	-10.878	0.584	304.97	152.49	340.97	23.046	3.419	-11.369
72.000	2.356	2969.04	1484.52	3319.48	18.300	-0.277	-10.871	0.565	279.61	139.80	312.61	22.958	3.408	-11.360
74.000	2.342	2947.61	1473.80	3295.52	18.218	-0.271	-10.862	0.515	213.84	106.92	239.08	22.945	3.400	-11.359
76.000	2.282	2851.26	210.71	2859.04	18.125	-0.274	-10.853	0.436	108.38	54.19	121.18	23.013	3.395	-11.366
78.000	2.180	2688.19	119.57	2690.85	18.036	-0.292	-10.843	0.328	45.56	22.78	50.93	23.161	3.390	-11.381
80.000	2.039	2461.74	235.32	2472.96	17.954	-0.332	-10.835	0.191	18.66	9.33	20.85	23.244	3.381	-11.390

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 1 (SEAT. 6 DEGREE OFF H) VS. SEGMENT 9 (LUL)							PANEL 2 (BACK PANEL. 13 DEGR) VS. SEGMENT 1 (LT)						
TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.250	29.94	0.00	29.94	24.725	-3.420	-11.545	0.055	2.77	0.00	2.77	9.382	0.000	-12.674
2.000	0.250	31.23	5.00	31.62	24.725	-3.420	-11.545	0.055	2.76	0.40	2.79	9.382	0.000	-12.674
4.000	0.250	36.71	15.41	39.81	24.726	-3.420	-11.545	0.054	2.68	0.97	2.85	9.382	0.000	-12.675
6.000	0.250	44.24	22.12	49.46	24.727	-3.420	-11.545	0.050	2.51	1.25	2.80	9.382	0.000	-12.676
8.000	0.251	51.74	25.87	57.84	24.729	-3.420	-11.546	0.044	2.18	1.09	2.44	9.382	0.000	-12.677
10.000	0.251	58.41	29.21	65.30	24.732	-3.420	-11.546	0.033	1.65	0.83	1.85	9.381	0.000	-12.680
12.000	0.252	63.91	31.95	71.45	24.737	-3.420	-11.546	0.017	0.86	0.43	0.96	9.380	0.000	-12.684
14.000	0.253	68.45	34.23	76.53	24.744	-3.420	-11.547	-0.006	0.00	0.00	0.00	0.000	0.000	0.000
16.000	0.254	72.21	36.10	80.73	24.755	-3.420	-11.548	-0.036	0.00	0.00	0.00	0.000	0.000	0.000
18.000	0.255	75.19	37.60	84.07	24.770	-3.420	-11.550	-0.077	0.00	0.00	0.00	0.000	0.000	0.000
20.000	0.256	76.31	38.16	85.32	24.790	-3.420	-11.552	-0.128	0.00	0.00	0.00	0.000	0.000	0.000
22.000	0.257	74.63	37.31	83.43	24.815	-3.420	-11.555	-0.192	0.00	0.00	0.00	0.000	0.000	0.000
24.000	0.257	65.18	32.59	72.87	24.849	-3.420	-11.558	-0.269	0.00	0.00	0.00	0.000	0.000	0.000
26.000	0.257	56.40	28.20	63.06	24.891	-3.420	-11.563	-0.362	0.00	0.00	0.00	0.000	0.000	0.000
28.000	0.256	47.59	23.79	53.20	24.943	-3.420	-11.568	-0.472	0.00	0.00	0.00	0.000	0.000	0.000
30.000	0.254	34.68	17.34	38.78	25.005	-3.420	-11.575	-0.601	0.00	0.00	0.00	0.000	0.000	0.000
32.000	0.252	30.42	15.21	34.01	25.079	-3.419	-11.582	-0.749	0.00	0.00	0.00	0.000	0.000	0.000
34.000	0.248	29.66	14.83	33.16	25.168	-3.419	-11.592	-0.918	0.00	0.00	0.00	0.000	0.000	0.000
36.000	0.241	28.14	14.07	31.46	25.280	-3.419	-11.604	-1.108	0.00	0.00	0.00	0.000	0.000	0.000
38.000	0.227	25.44	12.72	28.44	25.426	-3.418	-11.619	-1.317	0.00	0.00	0.00	0.000	0.000	0.000
40.000	0.206	21.30	10.65	23.81	25.615	-3.415	-11.639	-1.546	0.00	0.00	0.00	0.000	0.000	0.000
42.000	0.179	16.89	8.45	18.89	25.850	-3.411	-11.663	-1.794	0.00	0.00	0.00	0.000	0.000	0.000
44.000	0.147	12.03	6.01	13.45	26.130	-3.405	-11.693	-2.056	0.00	0.00	0.00	0.000	0.000	0.000
46.000	0.112	6.87	3.43	7.68	26.435	-3.396	-11.725	-2.328	0.00	0.00	0.00	0.000	0.000	0.000
48.000	0.080	3.99	1.99	4.46	26.760	-3.386	-11.759	-2.601	0.00	0.00	0.00	0.000	0.000	0.000
50.000	0.056	2.78	1.39	3.11	27.008	-3.372	-11.785	-2.864	0.00	0.00	0.00	0.000	0.000	0.000
52.000	0.051	58.93	29.46	65.88	27.020	-3.355	-11.786	-3.104	0.00	0.00	0.00	0.000	0.000	0.000
54.000	0.076	84.08	42.04	94.01	26.648	-3.335	-11.747	-3.311	0.00	0.00	0.00	0.000	0.000	0.000
56.000	0.137	138.11	69.06	154.41	26.015	-3.313	-11.681	-3.479	0.00	0.00	0.00	0.000	0.000	0.000
58.000	0.228	165.60	82.80	185.14	25.312	-3.292	-11.607	-3.609	0.00	0.00	0.00	0.000	0.000	0.000
60.000	0.353	148.11	74.06	165.60	24.605	-3.280	-11.533	-3.695	0.00	0.00	0.00	0.000	0.000	0.000
62.000	0.522	357.14	178.57	399.30	23.920	-3.280	-11.461	-3.747	0.00	0.00	0.00	0.000	0.000	0.000
64.000	0.684	686.47	343.24	767.50	23.448	-3.290	-11.411	-3.784	0.00	0.00	0.00	0.000	0.000	0.000
66.000	0.819	1246.33	623.16	1393.44	23.155	-3.301	-11.380	-3.811	0.00	0.00	0.00	0.000	0.000	0.000
68.000	0.905	1699.87	849.94	1900.52	22.994	-3.313	-11.364	-3.828	0.00	0.00	0.00	0.000	0.000	0.000
70.000	0.924	758.55	379.27	848.08	22.932	-3.322	-11.357	-3.837	0.00	0.00	0.00	0.000	0.000	0.000
72.000	0.888	710.46	355.23	794.31	22.936	-3.329	-11.358	-3.838	0.00	0.00	0.00	0.000	0.000	0.000
74.000	0.814	611.98	305.99	684.21	22.992	-3.333	-11.363	-3.831	0.00	0.00	0.00	0.000	0.000	0.000
76.000	0.713	477.86	238.93	534.26	23.096	-3.334	-11.374	-3.811	0.00	0.00	0.00	0.000	0.000	0.000
78.000	0.591	314.21	157.11	351.30	23.266	-3.333	-11.392	-3.793	0.00	0.00	0.00	0.000	0.000	0.000
80.000	0.450	126.56	63.28	141.50	23.529	-3.333	-11.420	-3.782	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 2 (BACK PANEL. 13 DEGR) VS. SEGMENT 2 (CT)							PANEL 2 (BACK PANEL. 13 DEGR) VS. SEGMENT 3 (UT)						
	DEFL-	NORMAL	FRICTION	RESULTANT	CONTACT LOCATION (IN.)			DEFL-	NORMAL	FRICTION	RESULTANT	CONTACT LOCATION (IN.)		
TIME	ECTION	FORCE	FORCE	FORCE	(VEH REFERENCE)			ECTION	FORCE	FORCE	FORCE	(VEH REFERENCE)		
(MSEC)	(IN.)	(LB.)	(LB.)	(LB.)	X	Y	Z	(IN.)	(LB.)	(LB.)	(LB.)	X	Y	Z
0.000	-0.312	0.00	0.00	0.00	0.000	0.000	0.000	0.133	9.90	0.00	9.90	6.151	0.000	-26.665
2.000	-0.312	0.00	0.00	0.00	0.000	0.000	0.000	0.132	9.87	0.06	9.87	6.151	0.000	-26.665
4.000	-0.314	0.00	0.00	0.00	0.000	0.000	0.000	0.131	9.61	0.75	9.64	6.151	0.000	-26.665
6.000	-0.320	0.00	0.00	0.00	0.000	0.000	0.000	0.126	8.90	1.74	9.07	6.151	0.000	-26.664
8.000	-0.330	0.00	0.00	0.00	0.000	0.000	0.000	0.117	7.52	2.55	7.94	6.152	0.000	-26.663
10.000	-0.347	0.00	0.00	0.00	0.000	0.000	0.000	0.102	5.25	2.42	5.77	6.152	0.000	-26.661
12.000	-0.372	0.00	0.00	0.00	0.000	0.000	0.000	0.079	3.95	1.98	4.42	6.153	0.000	-26.658
14.000	-0.406	0.00	0.00	0.00	0.000	0.000	0.000	0.048	2.38	1.19	2.66	6.154	0.000	-26.654
16.000	-0.452	0.00	0.00	0.00	0.000	0.000	0.000	0.006	0.30	0.15	0.33	6.155	0.000	-26.649
18.000	-0.510	0.00	0.00	0.00	0.000	0.000	0.000	-0.048	0.00	0.00	0.00	0.000	0.000	0.000
20.000	-0.583	0.00	0.00	0.00	0.000	0.000	0.000	-0.114	0.00	0.00	0.00	0.000	0.000	0.000
22.000	-0.671	0.00	0.00	0.00	0.000	0.000	0.000	-0.196	0.00	0.00	0.00	0.000	0.000	0.000
24.000	-0.776	0.00	0.00	0.00	0.000	0.000	0.000	-0.294	0.00	0.00	0.00	0.000	0.000	0.000
26.000	-0.901	0.00	0.00	0.00	0.000	0.000	0.000	-0.409	0.00	0.00	0.00	0.000	0.000	0.000
28.000	-1.045	0.00	0.00	0.00	0.000	0.000	0.000	-0.542	0.00	0.00	0.00	0.000	0.000	0.000
30.000	-1.211	0.00	0.00	0.00	0.000	0.000	0.000	-0.696	0.00	0.00	0.00	0.000	0.000	0.000
32.000	-1.400	0.00	0.00	0.00	0.000	0.000	0.000	-0.872	0.00	0.00	0.00	0.000	0.000	0.000
34.000	-1.612	0.00	0.00	0.00	0.000	0.000	0.000	-1.067	0.00	0.00	0.00	0.000	0.000	0.000
36.000	-1.849	0.00	0.00	0.00	0.000	0.000	0.000	-1.284	0.00	0.00	0.00	0.000	0.000	0.000
38.000	-2.110	0.00	0.00	0.00	0.000	0.000	0.000	-1.523	0.00	0.00	0.00	0.000	0.000	0.000
40.000	-2.397	0.00	0.00	0.00	0.000	0.000	0.000	-1.783	0.00	0.00	0.00	0.000	0.000	0.000
42.000	-2.707	0.00	0.00	0.00	0.000	0.000	0.000	-2.064	0.00	0.00	0.00	0.000	0.000	0.000
44.000	-3.034	0.00	0.00	0.00	0.000	0.000	0.000	-2.361	0.00	0.00	0.00	0.000	0.000	0.000
46.000	-3.370	0.00	0.00	0.00	0.000	0.000	0.000	-2.662	0.00	0.00	0.00	0.000	0.000	0.000
48.000	-3.702	0.00	0.00	0.00	0.000	0.000	0.000	-2.960	0.00	0.00	0.00	0.000	0.000	0.000
50.000	-4.012	0.00	0.00	0.00	0.000	0.000	0.000	-3.238	0.00	0.00	0.00	0.000	0.000	0.000
52.000	-4.276	0.00	0.00	0.00	0.000	0.000	0.000	-3.473	0.00	0.00	0.00	0.000	0.000	0.000
54.000	-4.477	0.00	0.00	0.00	0.000	0.000	0.000	-3.652	0.00	0.00	0.00	0.000	0.000	0.000
56.000	-4.606	0.00	0.00	0.00	0.000	0.000	0.000	-3.757	0.00	0.00	0.00	0.000	0.000	0.000
58.000	-4.661	0.00	0.00	0.00	0.000	0.000	0.000	-3.787	0.00	0.00	0.00	0.000	0.000	0.000
60.000	-4.582	0.00	0.00	0.00	0.000	0.000	0.000	-3.689	0.00	0.00	0.00	0.000	0.000	0.000
62.000	-4.378	0.00	0.00	0.00	0.000	0.000	0.000	-3.478	0.00	0.00	0.00	0.000	0.000	0.000
64.000	[illegible]	0.00	0.00	0.00	0.000	0.000	0.000	-3.225	0.00	0.00	0.00	0.000	0.000	0.000
66.000	-3.915	0.00	0.00	0.00	0.000	0.000	0.000	-2.965	0.00	0.00	0.00	0.000	0.000	0.000
68.000	-3.689	0.00	0.00	0.00	0.000	0.000	0.000	-2.720	0.00	0.00	0.00	0.000	0.000	0.000
70.000	-3.476	0.00	0.00	0.00	0.000	0.000	0.000	[illegible]	0.00	0.00	0.00	0.000	0.000	0.000
72.000	-3.281	0.00	0.00	0.00	0.000	0.000	0.000	-2.303	0.00	0.00	0.00	0.000	0.000	0.000
74.000	-3.098	0.00	0.00	0.00	0.000	0.000	0.000	-2.127	0.00	0.00	0.00	0.000	0.000	0.000
76.000	-2.921	0.00	0.00	0.00	0.000	0.000	0.000	-1.960	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-2.744	0.00	0.00	0.00	0.000	0.000	0.000	-1.791	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-2.561	0.00	0.00	0.00	0.000	0.000	0.000	-1.618	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 3 (FLOOR.) VS. SEGMENT 8 (RF)							PANEL 3 (FLOOR.) VS. SEGMENT 11 (LF)						
TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.096	4.82	0.00	4.82	46.596	3.420	-1.300	0.096	4.82	0.00	4.82	46.596	-3.420	-1.300
2.000	0.097	4.88	0.97	4.98	46.596	3.420	-1.300	0.097	4.88	0.97	4.98	46.596	-3.420	-1.300
4.000	0.097	4.97	2.11	5.40	46.597	3.420	-1.300	0.097	4.98	2.11	5.40	46.597	-3.420	-1.300
6.000	0.097	5.05	2.52	5.64	46.601	3.420	-1.300	0.097	5.05	2.52	5.64	46.601	-3.420	-1.300
8.000	0.098	5.02	2.51	5.62	46.609	3.420	-1.300	0.098	5.03	2.52	5.62	46.609	-3.420	-1.300
10.000	0.098	4.90	2.45	5.48	46.620	3.420	-1.300	0.098	4.91	2.46	5.49	46.620	-3.420	-1.300
12.000	0.098	4.88	2.44	5.46	46.638	3.420	-1.300	0.098	4.89	2.44	5.46	46.638	-3.420	-1.300
14.000	0.097	4.83	2.42	5.41	46.662	3.420	-1.300	0.097	4.84	2.42	5.41	46.662	-3.420	-1.300
16.000	0.095	4.75	2.37	5.31	46.693	3.420	-1.300	0.095	4.76	2.38	5.32	46.694	-3.420	-1.300
18.000	0.092	4.61	2.31	5.16	46.734	3.420	-1.300	0.093	4.63	2.31	5.17	46.734	-3.420	-1.300
20.000	0.088	4.42	2.21	4.94	46.784	3.420	-1.300	0.089	4.44	2.22	4.97	46.784	-3.420	-1.300
22.000	0.083	4.17	2.08	4.66	46.844	3.420	-1.300	0.084	4.19	2.10	4.69	46.845	-3.420	-1.300
24.000	0.077	3.85	1.92	4.30	46.915	3.420	-1.300	0.078	3.88	1.94	4.34	46.916	-3.420	-1.300
26.000	0.069	3.46	1.73	3.86	46.998	3.420	-1.300	0.070	3.50	1.75	3.91	46.999	-3.420	-1.300
28.000	0.060	2.99	1.50	3.35	47.092	3.420	-1.300	0.061	3.05	1.52	3.41	47.093	-3.420	-1.300
30.000	0.049	2.46	1.23	2.75	47.199	3.420	-1.300	0.051	2.54	1.27	2.83	47.201	-3.420	-1.300
32.000	0.037	1.85	0.93	2.07	47.318	3.420	-1.300	0.040	1.98	0.99	2.21	47.322	-3.420	-1.300
34.000	0.022	1.12	0.56	1.26	47.448	3.420	-1.300	0.027	1.36	0.68	1.52	47.456	-3.420	-1.300
36.000	0.004	0.19	0.10	0.21	47.583	3.420	-1.300	0.013	0.65	0.32	0.73	47.597	-3.420	-1.300
38.000	-0.021	0.00	0.00	0.00	0.000	0.000	0.000	-0.004	0.00	0.00	0.00	0.000	0.000	0.000
40.000	-0.052	0.00	0.00	0.00	0.000	0.000	0.000	-0.024	0.00	0.00	0.00	0.000	0.000	0.000
42.000	-0.092	0.00	0.00	0.00	0.000	0.000	0.000	-0.047	0.00	0.00	0.00	0.000	0.000	0.000
44.000	-0.140	0.00	0.00	0.00	0.000	0.000	0.000	-0.072	0.00	0.00	0.00	0.000	0.000	0.000
46.000	-0.199	0.00	0.00	0.00	0.000	0.000	0.000	-0.101	0.00	0.00	0.00	0.000	0.000	0.000
48.000	-0.268	0.00	0.00	0.00	0.000	0.000	0.000	-0.137	0.00	0.00	0.00	0.000	0.000	0.000
50.000	-0.348	0.00	0.00	0.00	0.000	0.000	0.000	-0.183	0.00	0.00	0.00	0.000	0.000	0.000
52.000	-0.[illegible]40	0.00	0.00	0.00	0.000	0.000	0.000	-0.245	0.00	0.00	0.00	0.000	0.000	0.000
54.000	-0.543	0.00	0.00	0.00	0.000	0.000	0.000	-0.330	0.00	0.00	0.00	0.000	0.000	0.000
56.000	-0.661	0.00	0.00	0.00	0.000	0.000	0.000	-0.434	0.00	0.00	0.00	0.000	0.000	0.000
58.000	-0.798	0.00	0.00	0.00	0.000	0.000	0.000	-0.554	0.00	0.00	0.00	0.000	0.000	0.000
60.000	-0.960	0.00	0.00	0.00	0.000	0.000	0.000	-0.686	0.00	0.00	0.00	0.000	0.000	0.000
62.000	-1.145	0.00	0.00	0.00	0.000	0.000	0.000	-0.830	0.00	0.00	0.00	0.000	0.000	0.000
64.000	-1.351	0.00	0.00	0.00	0.000	0.000	0.000	-0.974	0.00	0.00	0.00	0.000	0.000	0.000
66.000	-1.576	0.00	0.00	0.00	0.000	0.000	0.000	-1.122	0.00	0.00	0.00	0.000	0.000	0.000
68.000	-1.817	0.00	0.00	0.00	0.000	0.000	0.000	-1.277	0.00	0.00	0.00	0.000	0.000	0.000
70.000	-2.071	0.00	0.00	0.00	0.000	0.000	0.000	-1.446	0.00	0.00	0.00	0.000	0.000	0.000
72.000	-2.335	0.00	0.00	0.00	0.000	0.000	0.000	-1.625	0.00	0.00	0.00	0.000	0.000	0.000
74.000	-2.606	0.00	0.00	0.00	0.000	0.000	0.000	-1.812	0.00	0.00	0.00	0.000	0.000	0.000
76.000	-2.883	0.00	0.00	0.00	0.000	0.000	0.000	-2.005	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-3.160	0.00	0.00	0.00	0.000	0.000	0.000	-2.199	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-3.434	0.00	0.00	0.00	0.000	0.000	0.000	-2.38[illegible]	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEA..
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

PANEL 4 (HEAD PAD. 13 DEGR) VS. SEGMENT 5 (H)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.050	2.48	0.00	2.48	3.935	0.000	-40.978
2.000	0.049	2.47	0.02	2.47	3.935	0.000	-40.978
4.000	0.048	2.38	0.19	2.39	3.935	0.000	-40.978
6.000	0.043	2.15	0.41	2.19	3.935	0.000	-40.977
8.000	0.034	1.70	0.55	1.78	3.935	0.000	-40.976
10.000	0.019	0.95	0.41	1.03	3.936	0.000	-40.974
12.000	-0.003	0.00	0.00	0.00	0.000	0.000	0.000
14.000	-0.034	0.00	0.00	0.00	0.000	0.000	0.000
16.000	-0.075	0.00	0.00	0.00	0.000	0.000	0.000
18.000	-0.128	0.00	0.00	0.00	0.000	0.000	0.000
20.000	-0.194	0.00	0.00	0.00	0.000	0.000	0.000
22.000	-0.274	0.00	0.00	0.00	0.000	0.000	0.000
24.000	-0.371	0.00	0.00	0.00	0.000	0.000	0.000
26.000	-0.484	0.00	0.00	0.00	0.000	0.000	0.000
28.000	-0.617	0.00	0.00	0.00	0.000	0.000	0.000
30.000	-0.770	0.00	0.00	0.00	0.000	0.000	0.000
32.000	-0.945	0.00	0.00	0.00	0.000	0.000	0.000
34.000	-1.142	0.00	0.00	0.00	0.000	0.000	0.000
36.000	-1.363	0.00	0.00	0.00	0.000	0.000	0.000
38.000	-1.610	0.00	0.00	0.00	0.000	0.000	0.000
40.000	-1.882	0.00	0.00	0.00	0.000	0.000	0.000
42.000	-2.181	0.00	0.00	0.00	0.000	0.000	0.000
44.000	-2.505	0.00	0.00	0.00	0.000	0.000	0.000
46.000	-2.849	0.00	0.00	0.00	0.000	0.000	0.000
48.000	-3.211	0.00	0.00	0.00	0.000	0.000	0.000
50.000	-3.584	0.00	0.00	0.00	0.000	0.000	0.000
52.000	-3.960	0.00	0.00	0.00	0.000	0.000	0.000
54.000	-4.328	0.00	0.00	0.00	0.000	0.000	0.000
56.000	-4.675	0.00	0.00	0.00	0.000	0.000	0.000
58.000	-4.989	0.00	0.00	0.00	0.000	0.000	0.000
60.000	-5.254	0.00	0.00	0.00	0.000	0.000	0.000
62.000	-5.458	0.00	0.00	0.00	0.000	0.000	0.000
64.000	-5.609	0.00	0.00	0.00	0.000	0.000	0.000
66.000	-5.724	0.00	0.00	0.00	0.000	0.000	0.000
68.000	-5.817	0.00	0.00	0.00	0.000	0.000	0.000
70.000	-5.894	0.00	0.00	0.00	0.000	0.000	0.000
72.000	-5.963	0.00	0.00	0.00	0.000	0.000	0.000
74.000	-6.032	0.00	0.00	0.00	0.000	0.000	0.000
76.000	-6.105	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-6.178	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-6.252	0.00	0.00	0.00	0.000	0.000	0.000

PANEL 10 (RUDDER PEDALS.) VS. SEGMENT 8 (RF)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.002	0.08	0.00	0.08	51.239	3.420	-3.286
2.000	0.001	0.07	0.01	0.07	51.239	3.420	-3.286
4.000	0.002	0.11	0.04	0.12	51.239	3.420	-3.285
6.000	0.005	0.29	0.14	0.32	51.240	3.420	-3.287
8.000	0.010	0.75	0.37	0.83	51.245	3.420	-3.291
10.000	0.019	1.59	0.80	1.78	51.254	3.420	-3.298
12.000	0.031	2.66	1.33	2.98	51.266	3.420	-3.309
14.000	0.048	4.09	2.05	4.58	51.284	3.420	-3.323
16.000	0.070	5.92	2.96	6.62	51.306	3.420	-3.342
18.000	0.096	8.17	4.08	9.13	51.334	3.420	-3.365
20.000	0.128	13.66	6.83	15.28	51.367	3.420	-3.393
22.000	0.165	20.41	10.21	22.82	51.406	3.420	-3.426
24.000	0.205	28.17	14.09	31.50	51.464	3.420	-3.474
26.000	0.249	38.47	19.24	43.01	51.490	3.420	-3.496
28.000	0.296	49.29	24.64	55.10	51.503	3.420	-3.507
30.000	0.343	60.44	30 22	67.58	51.511	3.420	-3.514
32.000	0.392	71.83	35.92	80.31	51.516	3.420	-3.518
34.000	0.440	128.19	64.09	143.32	51.520	3.420	-3.521
36.000	0.477	178.75	89.37	199.85	51.521	3.420	-3.522
38.000	0.496	204.92	102.46	229.11	51.519	3.420	-3.521
40.000	0.498	191.03	95.51	213.58	51.515	3.420	-3.517
42.000	0.492	182.60	91.30	204.15	51.508	3.419	-3.511
44.000	0.482	168.82	84.41	188.75	51.501	3.418	-3.505
46.000	0.470	153.91	76.96	172.08	51.494	3.417	-3.499
48.000	0.460	139.82	69.91	156.32	51.489	3.415	-3.495
50.000	0.450	126.65	63.33	141.60	51.488	3.413	-3.495
52.000	0.441	114.28	57.14	127.77	51.494	3.410	-3.499
54.000	0.430	100.59	50.30	112.47	51.507	3.406	-3.510
56.000	0.415	79.36	39.68	88.73	51.531	3.402	-3.531
58.000	0.388	57.60	28.80	64.40	51.577	3.398	-3.569
60.000	0.346	49.17	24.59	54.98	51.679	3.394	-3.654
62.000	0.289	37.73	18.86	42.18	51.812	3.392	-3.767
64.000	0.215	23.04	11.52	25.75	51.976	3.393	-3.904
66.000	0.125	8.82	4.41	9.86	52.183	3.400	-4.077
68.000	0.020	0.99	0.49	1.10	52.440	3.417	-4.294
70.000	-0.101	0.00	0.00	0.00	0.000	0.000	0.000
72.000	-0.231	0.00	0.00	0.00	0.000	0.000	0.000
74.000	-0.367	0.00	0.00	0.00	0.000	0.000	0.000
76.000	-0.510	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-0.655	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-0.800	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

PANEL 10 (RUDDER PEDALS.) VS. SEGMENT 11 (LF)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.002	0.08	0.00	0.08	51.239	-3.420	-3.286
2.000	0.001	0.07	0.01	0.07	51.239	-3.420	-3.286
4.000	0.002	0.11	0.04	0.12	51.239	-3.420	-3.285
6.000	0.005	0.29	0.14	0.32	51.240	-3.420	-3.287
8.000	0.010	0.75	0.37	0.83	51.245	-3.420	-3.291
10.000	0.019	1.60	0.80	1.78	51.254	-3.420	-3.298
12.000	0.031	2.67	1.33	2.98	51.266	-3.420	-3.308
14.000	0.048	4.10	2.05	4.58	51.284	-3.420	-3.323
16.000	0.070	5.93	2.96	6.63	51.306	-3.420	-3.342
18.000	0.096	8.18	4.09	9.15	51.334	-3.420	-3.365
20.000	0.128	13.70	6.85	15.32	51.366	-3.420	-3.393
22.000	0.165	20.47	10.23	22.88	51.406	-3.420	-3.425
24.000	0.206	28.26	14.13	31.59	51.464	-3.420	-3.474
26.000	0.250	38.58	19.29	43.14	51.489	-3.420	-3.496
28.000	0.296	49.45	24.73	55.29	51.503	-3.420	-3.507
30.000	0.344	60.69	30.34	67.85	51.511	-3.420	-3.513
32.000	0.394	72.29	36.14	80.82	51.516	-3.420	-3.518
34.000	0.444	133.60	66.80	149.37	51.519	-3.420	-3.520
36.000	0.483	188.09	94.05	210.29	51.519	-3.420	-3.520
38.000	0.507	219.74	109.87	245.68	51.515	-3.420	-3.518
40.000	0.514	216.05	108.03	241.55	51.508	-3.420	-3.511
42.000	0.515	213.02	106.51	238.16	51.497	-3.421	-3.502
44.000	0.514	212.01	106.00	237.03	51.482	-3.422	-3.490
46.000	0.514	211.89	105.95	236.90	51.465	-3.423	-3.475
48.000	0.514	212.07	106.04	237.10	51.446	-3.425	-3.459
50.000	0.511	207.70	103.85	232.22	51.425	-3.427	-3.441
52.000	0.498	190.37	95.18	212.83	51.399	-3.430	-3.420
54.000	0.472	155.61	77.80	173.97	51.361	-3.432	-3.388
56.000	0.436	107.92	53.96	120.66	51.306	-3.435	-3.342
58.000	0.395	59.01	29.50	65.97	51.268	-3.437	-3.310
60.000	0.353	50.53	25.27	56.50	51.259	-3.438	-3.302
62.000	0.307	41.43	20.72	46.32	51.288	-3.438	-3.327
64.000	0.268	33.64	16.82	37.61	51.387	-3.436	-3.409
66.000	0.234	26.90	13.45	30.07	51.514	-3.432	-3.516
68.000	0.200	20.05	10.02	22.41	51.657	-3.425	-3.637
70.000	0.159	13.90	6.95	15.54	51.813	-3.413	-3.767
72.000	0.112	6.75	3.37	7.55	51.972	-3.393	-3.901
74.000	0.056	2.80	1.40	3.13	52.128	-3.366	-4.032
76.000	-0.008	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-0.077	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-0.141	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
HARNESS SYSTEM BELT ENDPOINT FORCES

	BELT NO. 1 OF HARNESS NO. 1				BELT NO. 2 OF HARNESS NO. 1			
	POINT NO. 1		POINT NO. 12		POINT NO. 13		POINT NO. 27	
TIME (MSEC)	STRAIN (IN./ IN.)	FORCE (LB.)	STRAIN (IN./ IN.)	FORCE (LB.)	STRAIN (IN./ IN.)	FORCE (LB.)	STRAIN (IN./ IN.)	FORCE (LB.)
0.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00
2.000	0.000025	0.37	0.000017	0.25	0.000014	0.21	0.000018	0.27
4.000	0.000119	1.79	0.000065	0.98	0.000057	0.85	0.000152	2.27
6.000	0.000281	4.22	0.000150	2.25	0.000124	1.86	0.000470	7.04
8.000	0.000523	7.85	0.000276	4.15	0.000219	3.29	0.001018	15.27
10.000	0.000854	12.81	0.000438	6.57	0.000336	5.04	0.001803	27.04
12.000	0.001023	15.34	0.000481	7.21	0.000344	5.16	0.002454	36.81
14.000	0.001320	19.80	0.000515	7.72	0.000433	6.50	0.003168	47.52
16.000	0.001672	25.08	0.000551	8.27	0.000496	7.44	0.003856	57.84
18.000	0.001420	21.30	0.000400	6.00	0.000404	6.06	0.003427	51.41
20.000	0.001831	27.4[illegible]	0.000484	7.26	0.000498	7.46	0.004276	64.13
22.000	0.002363	35.45	0.000617	9.26	0.000643	9.65	0.005479	82.19
24.000	0.003085	46.27	0.000877	13.15	0.000921	13.81	0.019008	285.12
26.000	0.004040	60.61	0.001215	18.22	0.001284	19.26	0.021036	315.53
28.000	0.006003	90.05	0.001724	25.85	0.001768	26.52	0.027340	410.10
30.000	0.009472	142.08	0.002256	33.83	0.002429	36.44	0.035707	564.14
32.000	0.013979	209.69	0.003249	48.73	0.004372	65.58	0.023671	355.06
34.000	0.019790	296.85	0.004754	71.30	0.008401	126.02	0.020865	312.97
36.000	0.026146	392.20	0.007124	106.86	0.018334	275.01	0.025025	375.38
38.000	0.032200	494.00	0.010831	162.46	0.030199	453.97	0.039302	636.04
40.000	0.037809	606.17	0.021023	315.35	0.040241	654.82	0.056200	1178.59
42.000	0.043063	711.27	0.036025	570.49	0.050245	863.00	0.075150	2182.96
44.000	0.048343	816.85	0.053858	1054.46	0.060539	1408.57	0.064897	1639.53
46.000	0.053827	1052.84	0.071518	1990.44	0.072248	2029.17	0.084525	2679.84
48.000	0.055271	1129.35	0.087363	2830.23	0.056456	1192.15	0.103767	3631.84
50.000	0.058800	1316.42	0.098307	3410.27	0.065766	1685.60	0.093883	3175.81
52.000	0.064710	1629.61	0.098688	3430.48	0.068526	1831.86	0.107224	3752.85
54.000	0.072120	2022.35	0.087992	2863.56	0.074577	2152.58	0.092638	3109.84
56.000	0.076068	2231.59	0.071069	1966.67	0.075155	2183.20	0.089018	2917.94
58.000	0.074497	2148.32	0.049516	840.31	0.069789	1898.82	0.084438	2675.23
60.000	0.061993	1485.61	0.026359	395.38	0.082583	2576.88	0.093363	3148.22
62.000	0.047024	790.48	0.005156	77.34	0.032040	490.80	0.086107	2763.69
64.000	0.028177	422.66	0.000000	0.00	0.024499	367.48	0.065353	1663.72
66.000	0.007038	105.57	0.000000	0.00	0.006231	93.46	0.051787	944.69
68.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.037962	609.25
70.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.022501	337.51
72.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.012711	190.67
74.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.006159	92.39
76.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00
78.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00
80.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT NO. 2 (CT) VS. SEGMENT NO. 13 (RLA)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 2 LOCAL REFERENCE X	Y	Z	SEG. 13 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.009	4.39	1.10	4.52	2.018	5.365	-1.749	-0.875	-0.809	-7.906
46.000	0.010	3.62	0.90	3.73	2.036	5.360	-1.739	-0.881	-0.803	-7.903
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
80.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT NO. 2 (CT) VS. SEGMENT NO. 15 (LLA)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 2 LOCAL REFERENCE X	Y	Z	SEG. 15 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
80.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT NO. 6 (RUL) VS. SEGMENT NO. 13 (RLA)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 6 LOCAL REFERENCE X	Y	Z	SEG. 13 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
80.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT NO. 9 (LUL) VS. SEGMENT NO. 15 (LLA)

	DEFL-	NORMAL	FRICTION	RESULTANT	CONTACT LOCATION (IN.)					
TIME	ECTION	FORCE	FORCE	FORCE	SEG. 9 LOCAL REFERENCE			SEG. 15 LOCAL REFERENCE		
(MSEC)	(IN.)	(LB.)	(LB.)	(LB.)	X	Y	Z	X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.282	132.75	33.19	136.84	1.229	-1.146	10.441	-1.121	0.658	6.935
80.000	0.685	321.84	80.46	331.75	1.096	-1.142	10.037	-1.019	0.683	6.725

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT NO. 13 (RLA) VS. SEGMENT NO. 16 (VEH)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 13 LOCAL REFERENCE X	Y	Z	SEG. 16 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.217	24.79	12.39	27.71	1.714	0.433	2.758	32.371	6.599	-23.212
70.000	0.496	193.03	96.51	215.81	1.651	0.426	3.110	32.482	6.706	-23.329
72.000	0.671	444.83	222.41	497.33	1.602	0.408	3.504	32.546	6.820	-23.401
74.000	0.627	362.71	181.36	405.53	1.587	0.388	3.859	32.512	6.921	-23.391
76.000	0.420	87.00	43.50	97.27	1.600	0.370	4.164	32.409	7.003	-23.320
78.000	0.219	23.90	11.95	26.72	1.612	0.354	4.449	32.311	7.076	-23.249
80.000	0.103	5.46	2.73	6.10	1.608	0.342	4.722	32.256	7.143	-23.206

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT NO. 15 (LLA) VS. SEGMENT NO. 16 (VEH)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 15 LOCAL REFERENCE X	Y	Z	SEG. 16 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.524	226.73	113.37	253.49	1.755	0.307	0.651	32.615	-6.119	-23.311
74.000	0.804	610.21	305.10	682.23	1.712	0.298	0.537	32.732	-6.130	-23.436
76.000	0.907	736.13	368.06	823.02	1.699	0.281	0.427	32.764	-6.147	-23.486
78.000	0.798	590.20	295.10	659.86	1.720	0.263	0.294	32.694	-6.176	-23.450
80.000	0.583	303.74	151.87	339.60	1.758	0.244	0.157	32.574	-6.224	-23.368

HIC, HSI AND CSI RESULTS
HEAD INJURY CRITERION

HIC = 192.44 TIME DURATION = 52.000 TO 65.000 MSEC
WITH HEAD RESULTANTS = 25.844 AND 23.464 G'S

AVERAGE HEAD RESULTANT FOR TIME DURATION = 46.574 G'S
HEAD SEVERITY INDEX

HSI = 245.20

MAX HEAD RESULTANT = 65.716 G'S AT 60.000 MSEC
CHEST SEVERITY INDEX

CSI = 733.64

MAX CHEST RESULTANT = 146.473 G'S AT 59.000 MSEC

ELAPSED CPU TIME = 126.39 SECONDS

SUB	CALLS	TIME	%
MAIN3D	1	213	1.69
INPUT	1	220	1.74
CHAIN	484	306	2.42
EJOINT	484	17	0.13
DINT	41	496	3.92
PDAUX	568	434	3.43
DAUX	483	520	4.11
SETUP1	483	236	1.87
CONTCT	483	235	1.86
PLELP	5313	901	7.13
SEGSEG	2898	886	7.01
HBELT	1072	1434	11.35
VISPR	483	758	6.00
SETUP2	483	89	0.70
DAUX11	483	629	4.98
DAUX12	483	181	1.43
DAUX22	483	110	0.87
FSMSOL	1072	1407	11.13
OUTPUT	86	1148	9.08
UPDATE	85	0	0.00
HPTURB	85	1628	12.88
DZP	482	148	1.17
POSTPR	1	643	5.09
TOTAL		12639	100.00

APPENDIX C4

Example 1, ATB Basic Sled Test Simulation
Perkin-Elmer Output File

DEVELOPED BY CALSPAN CORP., P.O. BOX 400, BUFFALO NY 14225
AND BY J&J TECHNOLOGIES INC., ORCHARD PARK, NY 14127

FOR THE AIR FORCE ARMSTRONG AEROSPACE MEDICAL RESEARCH
LABORATORY, WRIGHT PATTERSON AIR FORCE BASE
UNDER CONTRACTS F33615-75C-5002,-78C-0516 AND -80C-05117

AND FOR THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION,
U.S. DEPARTMENT OF TRANSPORTATION, UNDER CONTRACTS
FH-11-7592, HS-053-2-485, HS-6-01300 AND HS-6-01410.

PROGRAM DOCUMENTATION: NHTSA REPORT NOS. DOT-HS-801-507
THROUGH 510 (FORMERLY CALSPAN REPORT NO. ZQ-5180-L-1),
AVAILABLE FROM NTIS (ACCESSION NOS. PB-241692,3,4 AND 5),
APPENDIXES A-J TO THE ABOVE (AVAILABLE FROM CALSPAN),
AND REPORT NOS. AMRL-TR-75-14 (NTIS NO. AD-A014 816),
AFAMRL-TR-80-14 (NTIS NO. AD-A088 029), AND
AFAMRL-TR-83-073 (NTIS NO. AD-B079 184).

PROGRAM ATB-IV, EXECUTED ON THE AAMRL/BB CONCURRENT
3250 COMPUTER, WRIGHT-PATTERSON AFB, OHIO

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  2 SEPT 1988   IRSIN=   0  IRSOUT=   0  RSTIME =  0.0000                                                    CARDS A

EXAMPLE 1:  BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

   UNITL =  IN.     UNITM =  LB.     UNITT = SEC.     GRAVITY VECTOR = (    0.0000,     0.0000, 386.0880)    G = 386.0880

   NDINT =   4     NSTEPS =   40     DT =0.002000      H0 =0.000500      HMAX =0.001000      HMIN =0.000063

 NPRT ARRAY
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
    1  0 40  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1
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CARD B.1
CARDS B.2

SEGMENT			WEIGHT	PRINCIPAL MOMENTS OF INERTIA (LB.-SEC.**2- IN.)			SEGMENT CONTACT ELLIPSOID SEMIAXES (IN.)			CENTER (IN.)			PRINCIPAL AXES (DEG)		
I	SYM	PLOT	(LB.)	X	Y	Z	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL
1	LT	1	34.772	1.6280	1.0101	1.7954	5.168	7.436	3.778	0.000	0.000	-0.072	0.00	0.00	0.00
2	CT	2	13.099	0.4160	0.2301	0.5857	4.809	6.673	4.145	0.000	0.000	-0.011	0.00	0.00	0.00
3	UT	3	53.673	3.4525	2.7832	2.3509	5.220	6.906	7.314	0.000	0.000	-0.872	0.00	0.00	0.00
4	N	4	3.289	0.0278	0.0278	0.0216	2.520	2.520	3.156	0.000	0.000	0.000	0.00	0.00	0.00
5	H	5	11.927	0.2708	0.3085	0.1584	3.984	3.125	5.836	0.000	0.000	0.000	0.00	0.00	0.00
6	RUL	6	22.725	2.0130	2.0130	0.2576	3.308	3.308	12.652	0.000	0.000	0.000	0.00	0.00	0.00
7	RLL	7	9.763	0.4989	0.4989	0.0626	2.487	2.487	9.616	0.000	0.000	0.000	0.00	0.00	0.00
8	RF	8	2.079	0.0426	0.0412	0.0055	2.866	2.016	5.617	0.000	0.000	1.462	0.00	0.00	0.00
9	LUL	9	22.725	2.0130	2.0130	0.2576	3.308	3.308	12.652	0.000	0.000	0.000	0.00	0.00	0.00
10	LLL	A	9.763	0.4989	0.4989	0.0626	2.487	2.487	9.616	0.000	0.000	0.000	0.00	0.00	0.00
11	LF	B	2.079	0.0426	0.0412	0.0055	2.866	2.016	5.617	0.000	0.000	1.462	0.00	0.00	0.00
12	RUA	C	5.542	0.1743	0.1743	0.0259	2.122	2.122	7.497	0.000	0.000	0.000	0.00	0.00	0.00
13	RLA	D	5.901	0.3331	0.3331	0.0214	1.871	1.871	10.269	0.000	0.000	0.000	0.00	0.00	0.00
14	LUA	E	5.542	0.1743	0.1743	0.0259	2.122	2.122	7.497	0.000	0.000	0.000	0.00	0.00	0.00
15	LLA	F	5.901	0.3331	0.3331	0.0214	1.871	1.871	10.269	0.000	0.000	0.000	0.00	0.00	0.00

CARDS B.3

JOINT					LOCATION(IN.) - SEG(JNT)			LOCATION(IN.) - SEG(J+1)			PRIN. AXIS(DEG) - SEG(JNT)			PRIN. AXIS(DEG) - SEG(J+1)		
J	SYM	PLOT	JNT	PIN	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL	YAW	PITCH	ROLL
1	P	M	1	0	0.000	0.000	-3.850	0.000	0.000	1.610	0.00	0.00	0.00	0.00	5.00	0.00
2	W	N	2	0	0.000	0.000	-1.640	0.000	0.000	6.440	0.00	0.00	0.00	0.00	5.00	0.00
3	NP	O	3	0	0.000	0.000	-8.190	0.000	0.000	0.640	0.00	0.00	0.00	0.00	10.00	0.00
4	HP	P	4	0	0.000	0.000	-0.640	0.000	0.000	5.840	0.00	0.00	0.00	0.00	10.00	0.00
5	RH	Q	1	0	0.000	3.420	-0.310	0.000	0.000	-8.640	0.00	0.00	0.00	0.00	-45.00	0.00
6	RK	R	6	1	0.000	0.000	10.000	0.000	0.000	-6.970	0.00	0.00	0.00	0.00	60.00	0.00
7	RA	S	7	0	0.000	0.000	8.120	2.870	0.000	-2.660	0.00	90.00	0.00	0.00	10.00	0.00
8	LH	T	1	0	0.000	-3.420	-0.310	0.000	0.000	-8.640	0.00	0.00	0.00	0.00	-45.00	0.00
9	LK	U	9	1	0.000	0.000	10.000	0.000	0.000	-6.970	0.00	0.00	0.00	0.00	60.00	0.00
10	LA	V	10	0	0.000	0.000	8.120	2.870	0.000	-2.660	0.00	90.00	0.00	0.00	10.00	0.00
11	RS	W	3	0	0.000	6.240	-5.220	0.000	0.000	-5.370	0.00	0.00	0.00	0.00	-4.10	0.00
12	RE	X	12	1	0.000	0.000	5.420	0.000	0.000	-8.200	0.00	0.00	0.00	0.00	-70.00	0.00
13	LS	Y	3	0	0.000	-6.240	-5.220	0.000	0.000	-5.370	0.00	0.00	0.00	0.00	-4.10	0.00
14	LE	Z	14	1	0.000	0.000	5.420	0.000	0.000	-8.200	0.00	0.00	0.00	0.00	-70.00	0.00

CARDS B.4

JOINT		FLEXURAL SPRING CHARACTERISTICS: SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)	TORSIONAL SPRING CHARACTERISTICS: SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)
1	P	0.000	10.000	0.000	0.700	20.000	0.000	10.000	0.000	0.700	5.000
2	W	0.000	10.000	0.000	0.700	20.000	0.000	10.000	0.000	0.700	35.000
3	NP	0.000	5.000	0.000	0.700	25.000	0.000	10.000	0.000	0.700	35.000
4	HP	0.000	5.000	0.000	0.700	25.000	0.000	10.000	0.000	0.700	35.000
5	RH	0.000	10.000	0.000	0.700	70.000	0.000	0.800	0.000	0.700	40.000
6	RK	0.000	1.800	0.000	0.700	60.000	0.000	0.000	0.000	0.000	0.000
7	RA	0.000	7.000	0.000	0.700	35.000	0.000	10.000	0.000	0.700	26.000
8	LH	0.000	10.000	0.000	0.700	70.000	0.000	0.800	0.000	0.700	40.000
9	LK	0.000	1.800	0.000	0.700	60.000	0.000	0.000	0.000	0.000	0.000
10	LA	0.000	7.000	0.000	0.700	35.000	0.000	10.000	0.000	0.700	26.000
11	RS	0.000	10.000	0.000	0.700	122.500	0.000	10.000	0.000	0.700	65.000
12	RE	0.000	1.800	0.000	0.700	70.000	0.000	0.000	0.000	0.000	0.000
13	LS	0.000	10.000	0.000	0.700	122.500	0.000	10.000	0.000	0.700	65.000
14	LE	0.000	1.800	0.000	0.700	70.000	0.000	0.000	0.000	0.000	0.000

CARDS B.5

JOINT VISCOUS CHARACTERISTICS AND LOCK-UNLOCK CONDITIONS

JOINT		VISCOUS COEFFICIENT (IN. LB.SEC./DEG)	COULOMB FRICTION COEF. (IN. LB.)	FULL FRICTION ANGULAR VELOCITY (DEG/SEC.)	MAX TORQUE FOR A LOCKED JOINT (IN. LB.)	MIN TORQUE FOR UNLOCKED JOINT (IN. LB.)	MIN. ANG. VELOCITY FOR UNLOCKED JOINT (RAD/SEC.)	IMPULSE RESTITUTION COEFFICIENT
1	P	0.100	0.00	30.00	0.00	0.00	0.00	0.000
2	W	0.100	0.00	30.00	0.00	0.00	0.00	0.000
3	NP	0.100	0.00	30.00	0.00	0.00	0.00	0.000
4	HP	0.100	0.00	30.00	0.00	0.00	0.00	0.000
5	RH	0.100	0.00	30.00	0.00	0.00	0.00	0.000
6	RK	0.100	0.00	30.00	0.00	0.00	0.00	0.000
7	RA	0.100	0.00	30.00	0.00	0.00	0.00	0.000
8	LH	0.100	0.00	30.00	0.00	0.00	0.00	0.000
9	LK	0.100	0.00	30.00	0.00	0.00	0.00	0.000
10	LA	0.100	0.00	30.00	0.00	0.00	0.00	0.000
11	RS	0.100	0.00	30.00	0.00	0.00	0.00	0.000
12	RE	0.100	0.00	30.00	0.00	0.00	0.00	0.000
13	LS	0.100	0.00	30.00	0.00	0.00	0.00	0.000
14	LE	0.100	0.00	30.00	0.00	0.00	0.00	0.000

SEGMENT INTEGRATION CONVERGENCE TEST INPUT

SEGMENT		ANGULAR VELOCITIES (RAD/SEC.)			LINEAR VELOCITIES (IN./SEC.)			ANGULAR ACCELERATIONS (RAD/SEC.**2)			LINEAR ACCELERATIONS (IN./SEC.**2)		
NO.	SYM	MAG. TEST	ABS. ERROR	REL. ERROR	MAG. TEST	ABS. ERROR	REL. ERROR	MAG. TEST	ABS. ERROR	REL. ERROR	MAG. TEST	ABS. ERROR	REL. ERROR
1	LT	0.010	0.010	0.0100	0.010	0.010	0.0100	0.100	0.100	0.1000	0.100	0.100	0.0100
2	CT	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
3	UT	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
4	N	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
5	H	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
6	RUL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
7	RLL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
8	RF	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
9	LUL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
10	LLL	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
11	LF	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
12	RUA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
13	RLA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
14	LUA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000
15	LLA	0.010	0.010	0.0100	0.000	0.000	0.0000	0.100	0.100	0.1000	0.000	0.000	0.0000

SLED ACCELERATION - 20G PEAK

YAW	PITCH	ROLL	VIPS	VTIME	XO(X)	XO(Y)	XO(Z)	NATAB	ATO	ADT	MSEG
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15	0.000000	0.010000	0

UNIDIRECTIONAL VEHICLE POSITION TABLES

TIME (MSEC)	ACC (G)	VELOCITY (IN./SEC.)	POSITION (IN.)	TIME (MSEC)	ACC (G)	VELOCITY (IN./SEC.)	POSITION (IN.)
0.00000	0.00	0.0000	0.00000				
10.00000	5.00	-9.6522	-0.03217				
20.00000	10.00	-38.6088	-0.25739				
30.00000	15.00	-86.8698	-0.86870				
40.00000	20.00	-154.4352	-2.05914				
50.00000	15.00	-222.0006	-3.95740				
60.00000	10.00	-270.2616	-6.43480				
70.00000	5.00	-299.2182	-9.29829				
80.00000	0.00	-308.8704	-12.35482				
90.00000	0.00	-308.8704	-15.44352				
100.00000	0.00	-308.8704	-18.53222				
110.00000	0.00	-308.8704	-21.62093				
120.00000	0.00	-308.8704	-24.70963				
130.00000	0.00	-308.8704	-27.79834				
140.00000	0.00	-308.8704	-30.88704				

NPL	NBLT	NBAG	NELP	NQ	NSD	NHRNSS	NWINDF	NJNTF	NFORCE
12	0	0	3	0	0	1	0	0	0

CARD D.1

PLANE INPUTS

CARDS D.2

PLANE NO. 1 SEAT. 6 DEGREE OFF H

	X	Y	Z
POINT 1	10.0000	8.0000	-10.0000
POINT 2	28.0100	8.0000	-11.8900
POINT 3	10.0000	-8.0000	-10.0000

PLANE NO. 2 BACK PANEL. 13 DEGR

	X	Y	Z
POINT 1	1.0000	9.0000	-48.9700
POINT 2	10.0000	9.0000	-10.0000
POINT 3	1.0000	-9.0000	-48.9700

PLANE NO. 3 FLOOR.

	X	Y	Z
POINT 1	0.0000	12.0000	-1.3000
POINT 2	60.0000	12.0000	-1.3000
POINT 3	0.0000	-12.0000	-1.3000

PLANE NO. 4 HEAD PAD. 13 DEGR

	X	Y	Z
POINT 1	2.4800	7.5000	-47.2600
POINT 2	4.9600	7.5000	-36.5500
POINT 3	2.4800	-7.5000	-47.2600

PLANE NO. 5 SEAT FRONT PANEL.

	X	Y	Z
POINT 1	28.0100	8.0000	-11.8900
POINT 2	26.6600	8.0000	-4.4000
POINT 3	28.0100	-8.0000	-11.8900

PLANE NO. 6 BACK PANEL2. 13 DEGR

	X	Y	Z
POINT 1	1.0000	9.0000	-48.9700
POINT 2	10.0000	9.0000	-10.0000
POINT 3	1.0000	-9.0000	-48.9700

PLANE NO. 7 FIREWALL.

	X	Y	Z
POINT 1	60.0000	12.0000	-25.0000
POINT 2	60.0000	-12.0000	-25.0000
POINT 3	60.0000	12.0000	-0.7500

PLANE NO. 8 RIGHT SIDE SEAT/IN.

	X	Y	Z
POINT 1	8.4100	8.1000	-6.6600
POINT 2	8.7000	8.1000	-14.7300
POINT 3	30.5800	8.1000	-6.6400

PLANE NO. 9 LEFT SIDE SEAT/IN.

	X	Y	Z
POINT 1	8.4100	-8.1000	-6.6600
POINT 2	30.5800	-8.1000	-6.6400
POINT 3	8.7000	-8.1000	-14.7300

PLANE NO. 10 RUDDER PEDALS.

	X	Y	Z
POINT 1	49.9920	9.0000	-2.2392
POINT 2	52.9920	9.0000	-4.7565
POINT 3	49.9920	-9.0000	-2.2392

PLANE NO. 11 LEFT SIDE PANEL.

	X	Y	Z
POINT 1	1.0000	-9.0000	-48.9700
POINT 2	10.9000	-9.0000	-6.1000
POINT 3	-7.7700	-9.0000	-46.9500

PLANE NO. 12 RIGHT SIDE PANEL.

	X	Y	Z
POINT 1	1.0000	9.0000	-48.9700
POINT 2	-7.7700	9.0000	-46.9500
POINT 3	10.9000	9.0000	-6.1000

ADDITIONAL ELLIPSOID INPUT

CARDS D.5

NO.	SEMIAXES (IN.) X	Y	Z	OFFSET (IN.) X	Y	Z	ROTATION (DEG) YAW	PITCH	ROLL	POWER		
22	4.500	3.000	3.000	0.000	4.000	-3.500	0.000	0.000	0.000	0.	0.	0.
23	3.200	6.000	8.000	0.000	0.000	-7.000	0.000	0.000	0.000	0.	0.	0.
24	6.000	15.000	5.000	38.000	0.000	-28.000	0.000	0.000	0.000	20.	20.	20.

BODY SEGMENT SYMMETRY INPUT

CARD D.7

SEG NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NSYM(J)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FUNCTION NO. 3 SEGMENT-SEGMENT FCN. NTI(3) = 1

D0	D1	D2	D3	D4
0.0000	-5.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 6 TABULAR POINTS

D	F(D)
0.000000	0.0000
1.000000	470.0000
2.000000	890.0000
3.000000	1220.0000
4.000000	1470.0000
5.000000	1580.0000

FUNCTION NO. 6 CONSTANT, F=0.0 NTI(6) = 19 CARDS E

D0	D1	D2	D3	D4
0.0000	0.0000	0.0000	0.0000	0.0000

FUNCTION IS CONSTANT 0.000000

FUNCTION NO. 7 R FACTOR. NTI(7) = 24

D0	D1	D2	D3	D4
0.0000	0.0000	0.7000	0.0000	0.0000

FUNCTION IS CONSTANT 0.700000

FUNCTION NO. 13 STIFF SURFACES NTI(13) = 29

D0	D1	D2	D3	D4
0.0000	-4.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 8 TABULAR POINTS

D	F(D)
0.000000	0.0000
0.100000	5.0000
0.200000	20.0000
0.300000	40.0000
0.400000	60.0000
1.000000	860.0000
2.000000	2400.0000
3.000000	4000.0000

FUNCTION NO. 14 FRICTION FUNC. NTI(14) = 51

D0	D1	D2	D3	D4
0.0000	0.0000	0.5000	0.0000	1.0000

FUNCTION IS CONSTANT 0.500000

FUNCTION NO. 19 CF=.25,CREST=.25 NTI(19) = 56

D0	D1	D2	D3	D4
0.0000	0.0000	0.2500	0.0000	0.0000

FUNCTION IS CONSTANT 0.250000

FUNCTION NO. 20 DAMPING COEFF. C=900 NTI(20) = 61

D0	D1	D2	D3	D4
0.0000	1.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 5TH DEGREE POLYNOMIAL

A0	A1	A2	A3	A4	A5
0.000000	900.000000	0.000000	0.000000	0.000000	0.000000

FUNCTION NO. 21 RATE OF DEFLEC. NTI(21) = 72 CARDS E

D0	D1	D2	D3	D4
-40.0000	-150.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 21 TABULAR POINTS

D	F(D)
-40.000000	0.0000
-30.000000	0.0000
-20.000000	0.0000
-10.000000	0.0000
0.000000	0.0000
5.000000	1.0000
10.000000	1.0000
20.000000	0.9900
30.000000	0.9650
40.000000	0.9280
50.000000	0.8600
60.000000	0.6900
70.000000	0.4750
80.000000	0.3400
90.000000	0.2600
100.000000	0.2000
110.000000	0.1800
120.000000	0.0900
130.000000	0.0600
140.000000	0.0250
150.000000	0.0000

FUNCTION NO. 22 DAMPING COEFF. C=35 NTI(22) = 120

D0	D1	D2	D3	D4
0.0000	1.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 5TH DEGREE POLYNOMIAL

A0	A1	A2	A3	A4	A5
0.000000	35.000000	0.000000	0.000000	0.000000	0.000000

FUNCTION NO. 24 DAMPING COEFF. C=0.8 NTI(24) = 131

D0	D1	D2	D3	D4
-1000.0000	-1000.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 4 TABULAR POINTS

D	F(D)
-1000.000000	0.6000
-1.000000	0.6000
0.000000	1.0000
1000.000000	1.0000

FUNCTION NO. 25 DAMPING COEFF C=1100 NTI(25) = 145

D0	D1	D2	D3	D4
0.0000	1.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 5TH DEGREE POLYNOMIAL

A0	A1	A2	A3	A4	A5
0.000000	1100.000000	0.000000	0.000000	0.000000	0.000000

FUNCTION NO. 26 STIFF SURFACES-LL NTI(26) = 156

D0	D1	D2	D3	D4
0.0000	-4.0000	0.0000	0.0000	1.0000

FIRST PART OF FUNCTION - 8 TABULAR POINTS

D	F(D)
0.000000	0.0000
0.100000	5.0000
0.200000	20.0000
0.300000	40.0000
0.400000	60.0000
2.000000	860.0000
3.000000	2400.0000
4.000000	4000.0000

FUNCTION NO. 31 HARNESS FDF NTI(31) = 178

D0	D1	D2	D3	D4
0.0000	-4.0000	0.0000	0.0000	0.0000

FIRST PART OF FUNCTION - 8 TABULAR POINTS

D	F(D)
0.000000	0.0000
0.010000	150.0000
0.020000	300.0000
0.030000	450.0000
0.050000	850.0000
0.100000	3500.0000
1.000000	35000.0000
4.000000	140000.0000

FUNCTION NO. 32 HARNESS FRICTION NTI(32) = 200 CARDS E

D0	D1	D2	D3	D4
0.0000	0.0000	0.2000	0.0000	0.2000

FUNCTION IS CONSTANT 0.200000

FUNCTION NO. 34 HARNESS FRICTION NTI(34) = 205

D0	D1	D2	D3	D4
0.0000	0.0000	0.9000	0.0000	0.2000

FUNCTION IS CONSTANT 0.900000

CARDS F.1

PLANE	SEGMENT	FORCE DEFLECTION	INERTIAL SPIKE	R FACTOR	G FACTOR	FRICTION COEF.	OPT
1- 16	1- 1	13	-20	-21	0	14	1
SEAT. 6 DEGREE OFF H	LT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
1- 16	6- 6	13	-25	-21	0	14	1
SEAT. 6 DEGREE OFF H	RUL	STIFF SURFACES	DAMPING COEFF C=1100	RATE OF DEFLEC.		FRICTION FUNC.	
1- 16	9- 9	13	-25	-21	0	14	1
SEAT. 6 DEGREE OFF H	LUL	STIFF SURFACES	DAMPING COEFF C=1100	RATE OF DEFLEC.		FRICTION FUNC.	
2- 16	1- 1	13	-20	-21	0	14	1
BACK PANEL. 13 DEGR	LT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
2- 16	2- 2	13	-20	-21	0	14	1
BACK PANEL. 13 DEGR	CT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
2- 16	3- 3	13	-20	-21	0	14	1
BACK PANEL. 13 DEGR	UT	STIFF SURFACES	DAMPING COEFF. C=900	RATE OF DEFLEC.		FRICTION FUNC.	
3- 16	8- 8	13	-22	-21	0	14	-1
FLOOR.	RF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
3- 16	11- 11	13	-22	-21	0	14	-1
FLOOR.	LF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
4- 16	5- 5	13	-22	-21	0	14	1
HEAD PAD. 13 DEGR	H	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
10- 16	8- 8	13	-22	-21	0	14	1
RUDDER PEDALS.	RF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
10- 16	11- 11	13	-22	-21	0	14	1
RUDDER PEDALS.	LF	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	

CARDS F.3

SEGMENT	SEGMENT	FORCE DEFLECTION	INERTIAL SPIKE	R FACTOR	G FACTOR	FRICTION COEF.	OPT
2- 2	13- 13	3	0	7	0	19	0
CT	RLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST= 25	
2- 2	15- 15	3	0	7	0	19	0
CT	LLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST=.25	
6- 6	13- 13	3	0	7	0	19	0
RUL	RLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST=.25	
9- 9	15- 15	3	0	7	0	19	0
LUL	LLA	SEGMENT-SEGMENT FCN.		R FACTOR.		CF=.25,CREST=.25	
13- 13	16- 24	13	-22	-21	0	14	0
RLA	VEH	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	
15- 15	16- 24	13	-22	-21	0	14	0
LLA	VEH	STIFF SURFACES	DAMPING COEFF. C=35	RATE OF DEFLEC.		FRICTION FUNC.	

NO. OF HARNESSES = 1

NO. OF BELTS PER HARNESS = 2

FOR HARNESS NO. 1 NO. OF POINTS PER BELT = 12 15

HARNESS NO. 1 BELT NO. 1 FUNCTION NOS. 31 0 0 0 0 REFERENCE SLACK = 0.000 IN.

CARDS F.8.D

K	KS	KE	NT	NPD	NDR	FUNCTION NOS.				
1	16	0	109	1	1	0	0	0	0	0
2	1	1	115	0	1	0	0	0	0	34
3	1	1	121	0	1	0	0	0	0	34
4	1	1	127	0	1	0	0	0	0	34
5	1	1	133	0	1	0	0	0	0	34
6	1	23	139	0	1	0	0	0	0	0
7	1	1	145	0	1	0	0	0	0	34
8	1	1	151	0	1	0	0	0	0	34
9	1	1	157	0	1	0	0	0	0	34
10	1	1	163	0	1	0	0	0	0	34
11	1	1	169	0	1	0	0	0	0	34
12	16	0	175	1	1	0	0	0	0	0

	BASE REFERENCE (IN.)			ADJUSTED REFERENCE (IN.)			OFFSET (IN.)			PREFERRED DIRECTION (IN.)		
K	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
1	13.000	8.000	-10.300	13.000	8.000	-10.300	0.000	0.000	0.000	2.400	22.000	-0.300
2	-1.178	7.075	-0.781	-1.178	7.075	-0.781	0.000	0.000	-0.072	0.000	0.000	0.000
3	-0.029	6.796	-1.534	-0.029	6.795	-1.534	0.000	0.000	-0.072	0.000	0.000	0.000
4	0.910	5.778	-2.283	0.910	5.778	-2.283	0.000	0.000	-0.072	0.000	0.000	0.000
5	2.228	2.355	-3.192	2.228	2.355	-3.192	0.000	0.000	-0.072	0.000	0.000	0.000
6	2.957	0.000	3.059	2.957	0.000	3.059	0.000	0.000	-7.000	0.000	0.000	0.000
7	3.070	-0.080	-4.410	2.344	-0.061	-3.367	0.000	0.000	-0.072	0.000	0.000	0.000
8	1.785	-2.325	-3.343	1.785	-2.325	-3.343	0.000	0.000	-0.072	0.000	0.000	0.000
9	0.011	-5.145	-2.728	0.011	-5.145	-2.728	0.000	0.000	-0.072	0.000	0.000	0.000
10	-0.880	-5.789	-2.282	-0.880	-5.789	-2.282	0.000	0.000	-0.072	0.000	0.000	0.000
11	-2.460	-6.099	-1.200	-2.460	-6.098	-1.200	0.000	0.000	-0.072	0.000	0.000	0.000
12	13.000	-8.000	-10.300	13.000	-8.000	-10.300	0.000	0.000	0.000	2.400	22.000	-0.300

HARNESS NO. 1 BELT NO. 2 FUNCTION NOS. 31 0 0 0 0 REFERENCE SLACK = 0.000 IN.

CARDS F.8.D

K	KS	KE	NT	NPD	NDR	FUNCTION NOS.				
13	16	0	187	1	1	0	0	0	0	0
14	1	1	193	0	1	0	0	0	0	32
15	1	1	199	0	1	0	0	0	0	32
16	1	23	205	0	1	0	0	0	0	0
17	1	1	211	0	1	0	0	0	0	32
18	2	2	217	0	1	0	0	0	0	32
19	2	2	223	0	1	0	0	0	0	32
20	3	3	229	0	1	0	0	0	0	32
21	3	3	235	0	1	0	0	0	0	32
22	3	3	241	0	1	0	0	0	0	32
23	3	3	247	0	1	0	0	0	0	32
24	3	22	253	0	0	0	0	0	0	32
25	3	3	259	0	1	0	0	0	0	32
26	3	3	265	0	1	0	0	0	0	32
27	16	0	271	1	1	0	0	0	0	0

	BASE REFERENCE (IN.)			ADJUSTED REFERENCE (IN.)			OFFSET (IN.)			PREFERRED DIRECTION (IN.)		
K	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
13	13.000	-8.000	-10.300	13.000	-8.000	-10.300	0.000	0.000	0.000	0.700	17.500	-21.300
14	-2.445	-6.101	-1.213	-2.445	-6.101	-1.213	0.000	0.000	-0.072	0.000	0.000	0.000
15	-0.960	-6.000	-2.500	-0.906	-5.661	-2.359	0.000	0.000	-0.072	0.000	0.000	0.000
16	0.000	-5.700	3.800	0.000	-5.367	3.578	0.000	0.000	-7.000	0.000	0.000	0.000
17	0.010	-4.000	-4.500	0.008	-3.061	-3.443	0.000	0.000	-0.072	0.000	0.000	0.000
18	1.818	-5.439	-1.820	1.818	-5.439	-1.820	0.000	0.000	-0.011	0.000	0.000	0.000
19	2.500	-2.500	-1.500	3.397	-3.397	-2.038	0.000	0.000	-0.011	0.000	0.000	0.000
20	3.000	-1.500	6.500	2.777	-1.388	6.016	0.000	0.000	-0.872	0.000	0.000	0.000
21	4.487	-0.133	3.734	4.487	-0.133	3.734	0.000	0.000	-0.872	0.000	0.000	0.000
22	4.421	3.319	-1.662	4.421	3.319	-1.662	0.000	0.000	-0.872	0.000	0.000	0.000
23	0.879	4.202	-5.672	0.879	4.202	-5.672	0.000	0.000	-0.872	0.000	0.000	0.000
24	0.300	0.200	-2.800	0.320	0.213	-2.985	0.000	4.000	-3.500	0.000	0.000	0.000
25	-1.000	4.300	-6.000	-0.955	4.105	-5.728	0.000	0.000	-0.872	0.000	0.000	0.000

27	0.000	5.000	-35.200	0.000	5.000	-35.200	0.000	0.000	0.000	0.700	17.500	-21.300

ZPLT(X)	ZPLT(Y)	ZPLT(Z)	I1	J1	I2	J2	I3	SPLT(1)	SPLT(2)	SPLT(3)
0.	0.	0.	0	0	0	0	0	10.00	6.00	1.00

INITIAL POSITIONS (INERTIAL REFERENCE) CARDS G.2

SEGMENT		LINEAR POSITION (IN.)			LINEAR VELOCITY (IN./SEC.)		
NO.	SEG	X	Y	Z	X	Y	Z
1	LT	14.38100	0.00000	-13.75000	0.00000	0.00000	0.00000
2	CT	13.16068	0.00000	-19.07188	0.00000	0.00000	0.00000
3	UT	11.31383	0.00000	-26.93796	0.00000	0.00000	0.00000
4	N	9.28353	0.00000	-35.53137	0.00000	0.00000	0.00000
5	H	7.77521	0.00000	-41.83338	0.00000	0.00000	0.00000
6	RUL	22.94073	3.42000	-14.48930	0.00000	0.00000	0.00000
7	RLL	38.16022	3.42000	-10.39045	0.00000	0.00000	0.00000
8	RF	48.12719	3.42000	-4.45598	0.00000	0.00000	0.00000
9	LUL	22.94073	-3.42000	-14.48930	0.00000	0.00000	0.00000
10	LLL	38.16022	-3.42000	-10.39045	0.00000	0.00000	0.00000
11	LF	48.12719	-3.42000	-4.45598	0.00000	0.00000	0.00000
12	RUA	12.34164	6.24000	-27.13188	0.00000	0.00000	0.00000
13	RLA	22.75808	6.24000	-21.48521	0.00000	0.00000	0.00000
14	LUA	12.34164	-6.24000	-27.13188	0.00000	0.00000	0.00000
15	LLA	22.75808	-6.24000	-21.48521	0.00000	0.00000	0.00000

INITIAL ANGULAR ROTATION AND VELOCITY CARDS G.3

SEGMENT		ANGULAR ROTATION (DEG)			ANGULAR VELOCITY (DEG/SEC.)			IYPR			
NO.	SEG	YAW	PITCH	ROLL	X	Y	Z				
1	LT	0.00000	12.90000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
2	CT	0.00000	12.95000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
3	UT	0.00000	13.28000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
4	N	0.00000	13.46000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
5	H	0.00000	13.46000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
6	RUL	0.00000	92.90000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
7	RLL	0.00000	48.65000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
8	RF	0.00000	128.80000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
9	LUL	0.00000	92.90000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
10	LLL	0.00000	48.65000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
11	LF	0.00000	128.80000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
12	RUA	0.00000	24.50000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
13	RLA	0.00000	85.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
14	LUA	0.00000	24.50000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
15	LLA	0.00000	85.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0

LINEAR AND ANGULAR VELOCITIES HAVE BEEN SET EQUAL TO THE INITIAL VEHICLE VELOCITIES.

```
HBPLAY TIME =     0.000 MSEC. NH,NB,NPTS NT=    1     1    11   103
NL(1)=       1       2       3       4       5       6       8       9      10      11      12
BB   =          4.124   1.402   1.574   3.779   2.557   2.656   3.388   1.187   1.940   4.738

HBPLAY TIME =     0.000 MSEC. NH,NB,NPTS NT=    1     2     7   181
NL(1)=      13      14      18      21      22      23      27
BB   =          4.748   7.394   6.842   6.406   5.423  10.829
```

TABULAR TIME HISTORY CONTROL PARAMETERS

```
 TYPE  KSG    SELECTED SEGMENTS OR JOINTS
  H.1   3      3 -5  5
     REF       0  1 16
  H.2   3      3  5  5
     REF       0  0  3
  H.3   3      3  5  5
     REF       0  0  3
  H.4   3      3  5  5
     REF       0  0 16
  H.5   3      3  5  5
     REF       0  0  5
  H.6   3      3  5  5
     REF       0  0  3
  H.7   2      3  4
     REF       0  0
  H.8   0
     REF
  H.9   1      4
     REF       5
  H.10 15      1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
     REF      16
```

SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LT	0.0000	12.9000	0.0000	0.00000	0.00000	0.00000	0.000000	-26.834649	0.000000
2 CT	0.0000	12.9500	0.0000	0.00000	0.00000	0.00000	0.000000	40.304245	0.000000
3 UT	0.0000	13.2800	0.0000	0.00000	0.00000	0.00000	0.000000	-0.859459	0.000000
4 N	0.0000	13.4600	0.0000	0.00000	0.00000	0.00000	0.000000	13.637948	0.000000
5 H	0.0000	13.4600	0.0000	0.00000	0.00000	0.00000	0.000000	-1.165343	0.000000
6 RUL	0.0000	92.9000	0.0000	0.00000	0.00000	0.00000	0.000000	-2.405246	0.000000
7 RLL	0.0000	48.6500	0.0000	0.00000	0.00000	0.00000	0.000000	-12.215669	0.000000
8 RF	0.0000	128.8000	0.0000	0.00000	0.00000	0.00000	0.000000	56.318297	0.000000
9 LUL	0.0000	92.9000	0.0000	0.00000	0.00000	0.00000	0.000000	-2.405246	0.000000
10 LLL	0.0000	48.6500	0.0000	0.00000	0.00000	0.00000	0.000000	-12.215669	0.000000
11 LF	0.0000	128.8000	0.0000	0.00000	0.00000	0.00000	0.000000	56.318297	0.000000
12 RUA	0.0000	24.5000	0.0000	0.00000	0.00000	0.00000	0.000000	-6.917594	0.000000
13 RLA	0.0000	85.0000	0.0000	0.00000	0.00000	0.00000	0.000000	-34.722447	0.000000
14 LUA	0.0000	24.5000	0.0000	0.00000	0.00000	0.00000	0.000000	-6.917594	0.000000
15 LLA	0.0000	85.0000	0.0000	0.00000	0.00000	0.00000	0.000000	-34.722447	0.000000
16 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LT	14.3810	0.0000	-13.7500	0.00000	0.00000	0.00000	0.017822	0.000000	-0.088444
2 CT	13.1607	0.0000	-19.0719	0.00000	0.00000	0.00000	0.114863	0.000000	-0.110519
3 UT	11.3138	0.0000	-26.9380	0.00000	0.00000	0.00000	-0.038031	0.000000	-0.075446
4 N	9.2835	0.0000	-35.5314	0.00000	0.00000	0.00000	-0.042274	0.000000	-0.074372
5 H	7.7752	0.0000	-41.8334	0.00000	0.00000	0.00000	-0.047117	0.000000	-0.073212
6 RUL	22.9407	3.4200	-14.4893	0.00000	0.00000	0.00000	0.041548	0.000000	-0.039498
7 RLL	38.1602	3.4200	-10.3904	0.00000	0.00000	0.00000	-0.100994	0.000000	0.188268
8 RF	48.1272	3.4200	-4.4560	0.00000	0.00000	0.00000	-0.187590	0.000000	-0.183587
9 LUL	22.9407	-3.4200	-14.4893	0.00000	0.00000	0.00000	0.041548	0.000000	-0.039498
10 LLL	38.1602	-3.4200	-10.3904	0.00000	0.00000	0.00000	-0.100994	0.000000	0.188268
11 LF	48.1272	-3.4200	-4.4560	0.00000	0.00000	0.00000	-0.187590	0.000000	-0.183587
12 RUA	12.3416	6.2400	-27.1319	0.00000	0.00000	0.00000	-0.114274	0.000000	-0.038215
13 RLA	22.7581	6.2400	-21.4852	0.00000	0.00000	0.00000	-0.266915	0.000000	0.736709
14 LUA	12.3416	-6.2400	-27.1319	0.00000	0.00000	0.00000	-0.114274	0.000000	-0.038215
15 LLA	22.7581	-6.2400	-21.4852	0.00000	0.00000	0.00000	-0.266915	0.000000	0.736709
16 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT		(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1	LT	-0.1289D+03	0.0000D+00	-0.1135D+04	0.00000D+00	-0.48015D+02	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
2	CT	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
3	UT	0.6940D+02	0.0000D+00	0.3701D+03	0.00000D+00	-0.31861D+01	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
4	N	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
5	H	0.7822D+02	0.0000D+00	0.3680D+03	-0.13304D-18	-0.26721D+00	0.30851D-16	0.00000D+00	0.00000D+00	0.00000D+00
6	RUL	-0.5309D+02	0.0000D+00	-0.1198D+03	0.85493D-17	0.21827D+02	0.12373D-14	0.00000D+00	0.00000D+00	0.00000D+00
7	RLL	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
8	RF	-0.9511D+01	0.0000D+00	-0.5210D+03	0.00000D+00	-0.17610D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
9	LUL	-0.5309D+02	0.0000D+00	-0.1198D+03	0.85493D-17	0.21827D+02	0.12373D-14	0.00000D+00	0.00000D+00	0.00000D+00
10	LLL	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
11	LF	-0.9511D+01	0.0000D+00	-0.5210D+03	0.00000D+00	-0.17610D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
12	RUA	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
13	RLA	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
14	LUA	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
15	LLA	0.0000D+00	0.0000D+00	0.3861D+03	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00	0.00000D+00
								TOTAL BODY KINETIC ENERGY		
								0.00000D+00	0.00000D+00	0.00000D+00

JOINT		IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1	P	0	-0.177D+02	0.000D+00	-0.100D+03	0.0000D+00	0.0000D+00	0.0000D+00	0.000
2	W	0	-0.192D+02	0.000D+00	-0.859D+02	0.0000D+00	0.0000D+00	0.0000D+00	0.000
3	NP	0	-0.312D+01	0.000D+00	-0.158D+02	0.0000D+00	0.0000D+00	0.0000D+00	0.000
4	HP	0	-0.298D+01	0.000D+00	-0.122D+02	0.0000D+00	0.0000D+00	0.0000D+00	0.000
5	RH	0	0.274D+01	0.000D+00	0.653D+00	0.0000D+00	0.0000D+00	0.0000D+00	0.000
6	RK	1	-0.132D+01	0.000D+00	-0.550D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000
7	RA	0	-0.339D+00	0.000D+00	0.242D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000
8	LH	0	0.274D+01	0.000D+00	0.653D+00	0.0000D+00	0.0000D+00	0.0000D+00	0.000
9	LK	1	-0.132D+01	0.000D+00	-0.550D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000
10	LA	0	-0.339D+00	0.000D+00	0.242D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000
11	RS	0	-0.221D+01	0.000D+00	-0.731D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000
12	RE	1	-0.158D+01	0.000D+00	-0.155D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000
13	LS	0	-0.221D+01	0.000D+00	-0.731D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000
14	LE	1	-0.158D+01	0.000D+00	-0.155D+01	0.0000D+00	0.0000D+00	0.0000D+00	0.000

HARNESS BELT RESULTS FOR TIME = 0.000 MSEC.

POINT NO.	POINT INDEX	SEGMENT NO.	LENGTH (IN.)	BELT STRAIN ENERGY LOSS (IN. LB.)	(LOCAL OR ELLIPSOID) REFERENCE POINT (IN.) X	Y	Z	(INERTIAL) BELT FORCES (LB.) X	Y	Z	PENETRATION ENERGY LOSS (IN. LB.)
BELT NO.	1 OF HARNESS NO. 1										
1	1	16	0.000	0.000	13.000	8.000	-10.300	0.000	0.000	0.000	0.000
2	2	1	4.124	0.000	-1.178	7.075	-0.781	0.000	0.000	0.000	0.000
3	3	1	1.402	0.000	-0.029	6.795	-1.534	0.000	0.000	0.000	0.000
4	4	1	1.574	0.000	0.910	5.778	-2.283	0.000	0.000	0.000	0.000
5	5	1	3.779	0.000	2.228	2.355	-3.192	0.000	0.000	0.000	0.000
6	6	1	2.557	0.000	2.957	0.000	3.059	0.000	0.000	0.000	0.000
7	8	1	2.656	0.000	1.785	-2.325	-3.343	0.000	0.000	0.000	0.000
8	9	1	3.388	0.000	0.011	-5.145	-2.728	0.000	0.000	0.000	0.000
9	10	1	1.187	0.000	-0.880	-5.789	-2.282	0.000	0.000	0.000	0.000
10	11	1	1.940	0.000	-2.460	-6.098	-1.200	0.000	0.000	0.000	0.000
11	12	16	4.738	0.000	13.000	-8.000	-10.300	0.000	0.000	0.000	0.000
TOTAL BELT ENERGY LOSS				0.000							0.000
BELT NO.	2 OF HARNESS NO. 1										
12	13	16	0.000	0.000	13.000	-8.000	-10.300	0.000	0.000	0.000	0.000
13	14	1	4.748	0.000	-2.445	-6.101	-1.213	0.000	0.000	0.000	0.000
14	18	2	7.394	0.000	1.818	-5.439	-1.820	0.000	0.000	0.000	0.000
15	21	3	6.842	0.000	4.487	-0.133	3.734	0.000	0.000	0.000	0.000
16	22	3	6.406	0.000	4.421	3.319	-1.662	0.000	0.000	0.000	0.000
17	23	3	5.423	0.000	0.879	4.202	-5.672	0.000	0.000	0.000	0.000
18	27	16	10.829	0.000	0.000	5.000	-35.200	0.000	0.000	0.000	0.000
TOTAL BELT ENERGY LOSS				0.000							0.000
TOTAL HARNESS ENERGY LOSS				0.000							0.000

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HPTURB ITER =  10 AT TIME =  16.000 MSEC.  DELMAX =  0.010537  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  18.000 MSEC.  DELMAX =  0.009232  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  19.000 MSEC.  DELMAX =  0.009627  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  20.000 MSEC.  DELMAX =  0.010050  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  21.000 MSEC.  DELMAX =  0.010116  SCALE =  1.000000

HBPLAY TIME =    22.000 MSEC. NH,NB,NPTS NT=     1     2     8   181
NL(1)=        13       14       18       21       22       23       24       27
BB   =          4.748    7.394    6.842    6.406    5.423    0.491   10.338

HPTURB ITER =  10 AT TIME =  22.000 MSEC.  DELMAX =  0.012349  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  23.000 MSEC.  DELMAX =  0.011517  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  24.000 MSEC.  DELMAX =  0.011234  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  25.000 MSEC.  DELMAX =  0.011569  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  26.000 MSEC.  DELMAX =  0.012320  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  28.000 MSEC.  DELMAX =  0.010639  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  29.000 MSEC.  DELMAX =  0.012461  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  30.000 MSEC.  DELMAX =  0.014987  SCALE =  1.000000

HBPLAY TIME =    31.000 MSEC. NH,NB,NPTS NT=     1     2     7   181
NL(1)=        13       14       18       21       22       24       27
BB   =          4.748    7.394    6.842    6.406    5.572   10.679

HPTURB ITER =  10 AT TIME =  31.000 MSEC.  DELMAX =  0.021341  SCALE =  1.000000

HBPLAY TIME =    32.000 MSEC. NH,NB,NPTS NT=     1     2     8   181
NL(1)=        13       14       18       21       22       23       24       27
BB   =          4.748    7.394    6.842    6.406    5.066    0.260   10.926

HPTURB ITER =  10 AT TIME =  32.000 MSEC.  DELMAX =  0.016547  SCALE =  1.000000

HBPLAY TIME =    33.000 MSEC. NH,NB,NPTS NT=     1     2     7   181
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BB   =        4.748   7.394   6.842   6.406   5.066  11.186

HPTURB ITER =  10 AT TIME =  33.000 MSEC.  DELMAX =  0.036770  SCALE =  1.000000

HBPLAY TIME =    34.000 MSEC. NH,NB,NPTS NT=     1     2     8    181
NL(1)=      13       14       18       21       22       23       24       27
BB   =        4.748   7.394   6.842   6.406   5.066   0.289  10.896

HPTURB ITER =  10 AT TIME =  34.000 MSEC.  DELMAX =  0.041013  SCALE =  1.000000

HBPLAY TIME =    35.000 MSEC. NH,NB,NPTS NT=     1     2     7    181
NL(1)=      13       14       18       21       22       24       27
BB   =        4.748   7.394   6.842   6.406   5.216  11.035

HPTURB ITER =  10 AT TIME =  35.000 MSEC.  DELMAX =  0.021221  SCALE =  1.000000

HBPLAY TIME =    36.000 MSEC. NH,NB,NPTS NT=     1     2     8    181
NL(1)=      13       14       18       21       22       23       24       27
BB   =        4.748   7.394   6.842   6.406   4.847   0.195  11.210

HPTURB ITER =  10 AT TIME =  36.000 MSEC.  DELMAX =  0.012648  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  37.000 MSEC.  DELMAX =  0.015643  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  38.000 MSEC.  DELMAX =  0.011152  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  39.000 MSEC.  DELMAX =  0.014391  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  40.000 MSEC.  DELMAX =  0.017690  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  41.000 MSEC.  DELMAX =  0.015081  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  42.000 MSEC.  DELMAX =  0.017005  SCALE =  1.000000

HBPLAY TIME =    43.000 MSEC. NH,NB,NPTS NT=     1     2     7    181
NL(1)=      13       14       18       21       22       24       27
BB   =        4.748   7.394   6.842   6.406   4.910  11.342

HPTURB ITER =  10 AT TIME =  43.000 MSEC.  DELMAX =  0.053120  SCALE =  1.000000

HBPLAY TIME =    44.000 MSEC. NH,NB,NPTS NT=     1     2     8    181
NL(1)=      13       14       18       21       22       23       24       27
BB   =        4.748   7.394   6.842   6.406   4.496   0.075  11.681

HPTURB ITER =  10 AT TIME =  44.000 MSEC.  DELMAX =  0.013932  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  45.000 MSEC.  DELMAX =  0.012674  SCALE =  1.000000

HBPLAY TIME =    46.000 MSEC. NH,NB,NPTS NT=     1     2     7    181
NL(1)=      13       18       21       22       23       24       27
BB   =       12.143   6.842   6.406   4.496   0.055  11.701

HPTURB ITER =  10 AT TIME =  46.000 MSEC.  DELMAX =  0.014891  SCALE =  1.000000

HBPLAY TIME =    47.000 MSEC. NH,NB,NPTS NT=     1     1    10    103
NL(1)=       1        3        4        5        6        8        9       10       11       12
BB   =        5.526   1.574   3.779   2.557   2.656   3.388   1.187   1.940   4.738

HPTURB ITER =  10 AT TIME =  47.000 MSEC.  DELMAX =  0.018982  SCALE =  1.000000

HBPLAY TIME =    48.000 MSEC. NH,NB,NPTS NT=     1     2     6    181
NL(1)=      13       18       21       22       24       27
BB   =       12.143   6.842   6.406   4.534  11.718

HPTURB ITER =  10 AT TIME =  48.000 MSEC.  DELMAX =  0.064777  SCALE =  1.000000

HBPLAY TIME =    49.000 MSEC. NH,NB,NPTS NT=     1     2     7    181
NL(1)=      13       18       21       22       23       24       27
BB   =       12.143   6.842   6.406   4.192   0.045  12.015

HPTURB ITER =  10 AT TIME =  49.000 MSEC.  DELMAX =  0.010077  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  50.000 MSEC.  DELMAX =  0.010283  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  51.000 MSEC.  DELMAX =  0.012303  SCALE =  1.000000

HBPLAY TIME =    52.000 MSEC. NH,NB,NPTS NT=     1     2     6    181
NL(1)=      13       18       21       22       24       27
BB   =       12.143   6.842   6.406   4.222  12.029
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HPTURB ITER =  10 AT TIME =  52.000 MSEC.  DELMAX =  0.055553  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  53.000 MSEC.  DELMAX =  0.035482  SCALE =  1.000000

HBPLAY TIME =    54.000 MSEC. NH,NB,NPTS NT=     1     1     9   103
NL(1)=        1       3       4       5       6       8       9      10      12
BB    =          5.526   1.574   3.779   2.557   2.656   3.388   1.187   6.678

HPTURB ITER =  10 AT TIME =  54.000 MSEC.  DELMAX =  0.024287  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  55.000 MSEC.  DELMAX =  0.015678  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  56.000 MSEC.  DELMAX =  0.011486  SCALE =  1.000000

HBPLAY TIME =    57.000 MSEC. NH,NB,NPTS NT=     1     2     7   181
NL(1)=       13      18      19      21      22      24      27
BB    =         12.143   1.887   4.955   6.406   3.880  12.372

HPTURB ITER =  10 AT TIME =  57.000 MSEC.  DELMAX =  0.385309  SCALE =  0.259532

HBPLAY TIME =    58.000 MSEC. NH,NB,NPTS NT=     1     2     8   181
NL(1)=       13      18      19      20      21      22      24      27
BB    =         12.143   1.887   1.817   3.139   6.406   3.880  12.372

HPTURB ITER =  10 AT TIME =  58.000 MSEC.  DELMAX =  0.443658  SCALE =  0.225399

HBPLAY TIME =    59.000 MSEC. NH,NB,NPTS NT=     1     2     9   181
NL(1)=       13      16      18      19      20      21      22      24      27
BB    =          7.889   4.253   1.887   1.817   3.139   6.406   3.974  12.277

HPTURB ITER =  10 AT TIME =  59.000 MSEC.  DELMAX =  0.052001  SCALE =  1.000000

HBPLAY TIME =    60.000 MSEC. NH,NB,NPTS NT=     1     2     8   181
NL(1)=       13      18      19      20      21      22      24      27
BB    =         12.143   1.887   1.817   3.139   6.406   4.086  12.165

HPTURB ITER =  10 AT TIME =  60.000 MSEC.  DELMAX =  0.057808  SCALE =  1.000000

HBPLAY TIME =    61.000 MSEC. NH,NB,NPTS NT=     1     2     7   181
NL(1)=       13      18      20      21      22      24      27
BB    =         12.143   3.703   3.139   6.406   4.156  12.096

HPTURB ITER =  10 AT TIME =  61.000 MSEC.  DELMAX =  0.015872  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  62.000 MSEC.  DELMAX =  0.022130  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  63.000 MSEC.  DELMAX =  0.015337  SCALE =  1.000000

HBPLAY TIME =    64.000 MSEC. NH,NB,NPTS NT=     1     2     6   181
NL(1)=       13      18      20      21      22      27
BB    =         12.143   3.703   3.139   6.406  16.252

HPTURB ITER =  10 AT TIME =  64.000 MSEC.  DELMAX =  0.011067  SCALE =  1.000000

HBPLAY TIME =    66.000 MSEC. NH,NB,NPTS NT=     1     1     8   103
NL(1)=        1       3       4       5       6       8       9      12
BB    =          5.526   1.574   3.779   2.557   2.656   3.388   7.865

HPTURB ITER =  10 AT TIME =  67.000 MSEC.  DELMAX =  0.011853  SCALE =  1.000000

HPTURB ITER =  10 AT TIME =  69.000 MSEC.  DELMAX =  0.013454  SCALE =  1.000000

DINT CONV. TEST    72.000   N    ANG VEL    22.55      0.2652E-02  0.1176E-03  0.1000E-03  0.1000E-03  0.1000E-03

TEST FAILED AT TIME =   0.072000 FOR H =   0.001000

DINT CONV. TEST    73.000   N    ANG VEL    23.86      0.3624E-02  0.1518E-03  0.1000E-03  0.1000E-03  0.1000E-03

TEST FAILED AT TIME =   0.073000 FOR H =   0.001000

DINT CONV. TEST    74.000   N    ANG VEL    26.11      0.3039E-02  0.1164E-03  0.1000E-03  0.1000E-03  0.1000E-03

TEST FAILED AT TIME =   0.074000 FOR H =   0.001000
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SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LT	10.9078	40.4616	-2.5237	-3.50101	6.77176	3.01702	-712.525841	-923.312215	-344.896206
2 CT	5.8648	8.3877	-35.0629	-28.78011	38.13662	26.32712	2669.823703	4863.705052	714.436129
3 UT	22.6603	16.1876	4.2073	-4.55898	-8.33212	11.28470	-833.189019	-740.536145	24.730107
4 N	9.4134	-28.3216	9.0212	3.10468	-11.10456	11.62142	-474.529280	-2359.202265	525.452347
5 H	-14.7037	-62.0894	29.6482	16.06835	-58.33883	6.84809	321.909908	-351.659929	252.225950
6 RUL	11.0166	100.4701	10.5736	-0.26043	-3.94123	-2.59116	-82.766870	-780.201793	66.972957
7 RLL	-2.0078	53.9069	-3.2449	-2.05452	9.15294	-1.60027	12.275725	-89.117047	79.212811
8 RF	-1.2125	146.0433	2.4774	3.41634	1.03537	-1.56581	-92.295830	747.087281	-23.919556
9 LUL	4.3688	101.7927	4.4680	-0.37199	-3.33541	-0.44435	-290.296221	-679.956631	528.292676
10 LLL	-0.9289	45.3497	-1.2981	-0.57596	5.97768	0.06395	278.790377	-4.508498	528.778814
11 LF	-0.5610	155.8698	1.6050	1.79239	0.13205	-0.59660	-177.520464	1209.576339	196.625307
12 RUA	-75.0950	70.5657	-80.2833	-6.23227	-4.14211	-1.63954	244.397026	-3261.631891	-168.345676
13 RLA	-21.0534	51.2884	-31.6271	-6.18955	1.21106	1.79408	113.635226	2487.522774	-303.100899
14 LUA	-17.8558	62.4794	-23.3643	-2.95595	-0.00123	5.46149	322.014086	-2838.181399	888.201217
15 LLA	-16.0460	60.3973	-21.7744	-2.73881	-15.25083	5.57354	441.700349	4146.746559	916.611615
16 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LT	6.0377	0.0702	-13.0395	-334.65671	-2.92122	-92.21272	1.118456	-3.419755	-24.241372
2 CT	3.5221	-1.5083	-17.2697	-403.89532	-63.36301	-39.55188	-7.411998	0.308363	-23.341359
3 UT	1.5893	-2.7194	-24.7657	-399.28403	-115.11128	-20.63141	-8.535068	3.408484	-20.077252
4 N	-0.46[illegible]1	-2.8941	-33.1662	-319.46157	-121.58509	-38.64033	16.009901	-4.901599	-22.093312
5 H	4.8[illegible]68	-1.0902	-36.0984	-178.47710	-69.83431	287.80272	-29.256214	-10.703850	8.134162
6 RUL	13.6013	3.3950	-14.9332	-345.17072	-4.32318	-59.80904	2.896528	-1.986709	-14.025632
7 RLL	29.0739	3.6383	-12.6201	-300.76311	12.64266	-73.16830	3.883535	0.620604	6.154392
8 RF	39.4986	3.6714	-8.4455	-258.02278	23.08008	-137.61724	0.173190	0.601745	-0.915789
9 LUL	15.0441	-3.3466	-14.9210	-314.88548	2.85212	-60.25035	6.374569	3.680291	-3.334002
10 LLL	29.7934	-3.3024	-12.0614	-278.81100	10.63011	-57.36381	9.156247	6.479980	13.521611
11 LF	39.2761	-3.3229	-7.6097	-244.93381	11.69052	-92.38042	4.608846	0.164379	1.561647
12 RUA	3.1574	3.4023	-29.0240	-426.99852	-109.61718	-32.04897	-2.643843	6.759738	6.506879
13 RLA	15.1710	5.9986	-24.3530	-429.54688	-25.03050	-46.34975	23.116917	3.958924	9.885922
14 LUA	7.1965	-8.0306	-27.9271	-282.38560	-78.35066	-29.72059	-9.173876	2.088389	27.959874
15 LLA	19.2594	-6.2444	-21.8664	-343.80786	-23.50199	71.96752	11.107169	-20.329519	-12.311190
16 VEH	-12.3548	0.0000	0.0000	-308.87040	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT		(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1	LT	-0.3009D+03	0.1559D+02	-0.2698D+05	-0.60308D+03	-0.27927D+04	-0.22971D+03	0.54266D+04	0.41308D+02	0.54679D+04
2	CT	0.2569D+03	-0.5220D+03	-0.6204D+03	0.88429D+04	0.83818D+04	0.71444D+03	0.28620D+04	0.54259D+03	0.34046D+04
3	UT	-0.6894D+03	-0.2430D+03	0.4419D+03	-0.69029D+03	-0.15455D+03	0.16513D+02	0.12032D+05	0.28218D+03	0.12314D+05
4	N	0.0000D+00	0.0000D+00	0.3861D+03	-0.26984D+04	0.10411D+05	0.52545D+03	0.50402D+03	0.33066D+01	0.50733D+03
5	H	0.0000D+00	0.0000D+00	0.3861D+03	-0.35125D+03	0.92855D+03	0.25223D+03	0.18467D+04	0.56365D+03	0.24104D+04
6	RUL	0.1244D+03	-0.7761D+01	0.5426D+02	-0.23939D+01	0.52884D+02	-0.10354D+01	0.36122D+04	0.16567D+02	0.36287D+04
7	RLL	0.0000D+00	0.0000D+00	0.3861D+03	-0.82176D+01	-0.24413D+03	-0.15598D+03	0.12134D+04	0.22031D+02	0.12355D+04
8	RF	0.0000D+00	0.0000D+00	0.3861D+03	-0.18022D+03	0.11120D+04	-0.75866D+03	0.23167D+03	0.27743D+00	0.23195D+03
9	LUL	-0.1221D+04	0.2472D+04	0.2645D+04	-0.70853D+03	-0.12076D+04	-0.31901D+03	0.30251D+04	0.11362D+02	0.30365D+04
10	LLL	0.0000D+00	0.0000D+00	0.3861D+03	-0.66486D+01	-0.17362D+03	-0.14022D+03	0.10259D+04	0.89964D+01	0.10349D+04
11	LF	0.0000D+00	0.0000D+00	0.3861D+03	-0.20969D+03	0.81201D+03	-0.72214D+02	0.18487D+03	0.69768D-01	0.18494D+03
12	RUA	0.0000D+00	0.0000D+00	0.3861D+03	-0.44483D+02	-0.70077D+04	0.79493D+03	0.14022D+04	0.49151D+01	0.14071D+04
13	RLA	-0.8603D+02	-0.4004D+01	0.7761D+03	0.31299D+02	0.34441D+04	-0.57371D+02	0.14312D+04	0.66593D+01	0.14379D+04
14	LUA	0.0000D+00	0.0000D+00	0.3861D+03	-0.16398D+03	-0.90273D+03	0.56251D+02	0.62271D+03	0.11478D+01	0.62386D+03
15	LLA	-0.9690D+04	-0.7116D+04	-0.3749D+04	0.20275D+04	0.70096D+04	0.12476D+04	0.94712D+03	0.40319D+02	0.98744D+03
								TOTAL BODY KINETIC ENERGY		
								0.36368D+05	0.15454D+04	0.37913D+05

JOINT		IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1	P	0	-0.478D+03	0.156D+03	-0.120D+04	0.1437D+04	0.1730D+04	-0.4588D+03	47.900
2	W	0	-0.373D+03	0.134D+03	-0.919D+03	-0.2162D+04	-0.6568D+03	0.7903D+03	63.460
3	NP	0	-0.296D+03	-0.144D+03	0.914D+01	-0.2178D+03	0.5526D+03	0.5465D+02	4.653
4	HP	0	-0.349D+03	-0.128D+03	0.851D+02	-0.8035D+02	0.2872D+03	0.4001D+02	48.641
5	RH	0	0.968D+02	-0.374D+02	-0.276D+03	0.1549D+01	0.6042D+02	0.1998D+02	11.110
6	RK	1	0.383D+02	0.731D+01	0.463D+02	-0.9820D+01	-0.7377D+02	0.4208D+02	13.094
7	RA	0	0.360D+00	0.125D+01	-0.398D+01	0.6057D+01	0.4563D+02	0.6082D+01	8.104
8	LH	0	0.316D+03	0.174D+01	-0.108D+03	-0.1049D+02	0.5690D+02	0.2195D+02	10.800
9	LK	1	0.990D+02	0.636D+02	0.123D+03	-0.1739D+03	-0.4959D+02	0.2365D+03	9.313
10	LA	0	0.958D+01	0.342D+00	0.117D+01	0.8697D+01	0.3333D+02	0.3159D+01	6.037
11	RS	0	0.123D+03	0.609D+02	0.770D+02	0.2329D+02	-0.3963D+02	0.2492D+02	9.125
12	RE	1	0.138D+03	0.234D+02	0.465D+02	-0.5987D+02	0.1090D+04	-0.4321D+03	5.353
13	LS	0	0.163D+03	0.378D+00	0.134D+03	-0.7896D+01	-0.5782D+02	0.3755D+02	12.112
14	LE	1	0.214D+03	-0.112D+02	-0.153D+02	-0.1860D+03	0.1440D+03	0.2989D+03	15.250

POSTPROCESSOR CONTROL PARAMETERS

	HIC & HSI POINT	CSI POINT
H.11	2	1

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

POINT TOTAL ACCELERATION (G'S)

TIME (MSEC)	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 3 - UT IN UT REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. -5 - H ACCELEROMETER (1G)				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN VEH REFERENCE			
	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	-0.020	0.000	-0.082	0.084	-0.262	0.000	0.890	0.928	-0.047	0.000	-0.073	0.087
2.000	-0.014	0.000	-0.107	0.108	-0.260	0.000	0.865	0.903	-0.051	0.000	-0.098	0.111
4.000	-0.007	0.000	-0.179	0.179	-0.258	0.000	0.793	0.834	-0.067	0.000	-0.168	0.181
6.000	-0.006	-0.003	-0.247	0.247	-0.269	0.000	0.725	0.774	-0.093	0.000	-0.232	0.250
8.000	-0.019	-0.012	-0.314	0.315	-0.306	-0.002	0.658	0.725	-0.144	-0.002	-0.289	0.323
10.000	-0.061	-0.023	-0.386	0.391	-0.379	-0.005	0.586	0.698	-0.233	-0.005	-0.342	0.413
12.000	-0.091	-0.032	-0.464	0.474	-0.475	-0.008	0.507	0.695	-0.344	-0.008	-0.396	0.525
14.000	-0.099	-0.023	-0.547	0.556	-0.487	-0.006	0.425	0.646	-0.375	-0.006	-0.474	0.604
16.000	-0.132	-0.024	-0.623	0.638	-0.506	-0.007	0.348	0.614	-0.411	-0.007	-0.544	0.682
18.000	-0.111	-0.005	-0.719	0.727	-0.510	-0.003	0.253	0.570	-0.437	-0.003	-0.635	0.771
20.000	-0.133	-0.001	-0.791	0.802	-0.525	-0.002	0.181	0.555	-0.468	-0.002	-0.702	0.844
22.000	-0.197	-0.016	-0.854	0.876	-0.551	-0.005	0.119	0.564	-0.509	-0.006	-0.756	0.911
24.000	-0.382	-0.063	-1.317	1.373	-0.662	-0.179	-0.342	0.767	-0.724	-0.179	-1.179	1.395
26.000	-0.390	-0.112	-1.296	1.358	-0.685	-0.231	-0.314	0.788	-0.739	-0.231	-1.147	1.384
28.000	-0.357	0.556	-1.166	1.340	-0.682	-0.014	-0.181	0.705	-0.705	-0.014	-1.019	1.239
30.000	-0.438	0.816	-1.246	1.553	-0.702	0.035	-0.256	0.748	-0.742	0.035	-1.087	1.317
32.000	-2.733	-0.835	-0.461	2.895	-1.271	-0.218	0.576	1.412	-1.106	-0.220	-0.149	1.137
34.000	-2.186	-0.420	-0.403	2.263	-1.208	-0.216	0.667	1.397	-1.025	-0.219	-0.076	1.051
36.000	-3.145	-0.474	-0.313	3.196	-1.481	-0.353	0.849	1.743	-1.252	-0.357	0.159	1.312
38.000	-4.178	-0.580	-1.221	4.391	-1.843	-0.709	0.133	1.979	-1.769	-0.710	-0.467	1.963
40.000	-5.137	0.364	-1.250	5.299	-2.004	-0.530	0.280	2.092	-1.897	-0.533	-0.297	1.993
42.000	-6.838	1.397	-2.254	7.334	-2.388	-0.543	-0.390	2.479	-2.417	-0.540	-0.885	2.630
44.000	-14.419	-3.743	0.830	14.920	-4.097	-1.242	3.893	5.787	-3.227	-1.300	3.624	5.024
46.000	-16.621	-1.760	-0.518	16.722	-4.375	-1.075	3.474	5.689	-3.633	-1.143	3.226	4.991
48.000	-21.535	0.772	0.632	21.558	-4.411	-0.608	5.515	7.088	-3.372	-0.744	5.190	6.234
50.000	-41.704	-14.755	6.467	44.707	-8.393	-3.295	18.145	20.262	-5.470	-3.858	18.124	19.321
52.000	-46.097	-12.754	8.809	48.633	-8.850	-2.015	24.198	25.844	-5.684	-2.996	24.033	24.877
54.000	-59.506	-18.177	14.142	63.807	-11.972	-2.812	40.775	42.589	-8.224	-4.949	40.493	41.615
56.000	-60.433	-15.422	13.472	63.808	-11.763	-2.643	48.226	49.710	-9.706	-5.876	47.398	48.737
58.000	-73.471	-17.978	-2.410	75.677	-11.839	-4.818	45.094	46.871	-12.593	-8.610	43.319	45.927
60.000	-93.922	-15.685	14.909	96.382	-10.687	1.243	64.829	65.716	-16.338	-5.515	62.414	64.752
62.000	-39.398	-7.543	-3.263	40.247	-8.458	0.385	50.073	50.783	-16.781	-5.749	46.585	49.848
64.000	-13.416	-3.242	-10.799	17.525	-4.985	0.413	34.219	34.583	-13.561	-4.374	30.511	33.674
66.000	2.837	-2.587	-20.041	20.406	-4.396	-0.971	17.138	17.719	-9.978	-3.581	13.198	16.929
68.000	12.171	-3.027	-29.353	31.921	-6.574	-2.288	10.559	12.647	-10.367	-3.898	5.106	12.195
70.000	12.817	-4.431	-27.755	30.891	-6.991	-2.721	11.812	13.993	-11.904	-4.656	4.693	13.617
72.000	8.827	-2.877	-26.335	27.924	-5.142	-2.316	12.679	13.876	-11.519	-4.665	5.172	13.461
74.000	3.362	-1.720	-32.445	32.664	-5.688	-2.458	13.892	15.211	-13.307	-5.198	4.223	14.897
76.000	-2.984	1.218	-32.702	32.861	-6.355	-2.850	21.202	22.317	-19.656	-7.488	6.458	22.003
78.000	-4.104	3.348	-30.967	31.417	-5.758	-2.791	26.452	27.215	-24.295	-9.144	7.173	26.932
80.000	-0.706	4.868	-21.526	22.081	-3.903	-2.154	32.157	32.464	-29.256	-10.704	8.134	32.197

RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

POINT REL. VELOCITY (IN./SEC.)

TIME (MSEC)	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 3 - UT IN VEH REFERENCE X	Y	Z	RES	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN VEH REFERENCE X	Y	Z	RES	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN UT REFERENCE X	Y	Z	RES
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.357	0.000	-0.064	0.362	0.349	0.000	-0.062	0.355	-0.008	0.000	0.000	0.008
4.000	1.482	0.000	-0.168	1.491	1.463	0.000	-0.163	1.472	-0.020	0.000	0.000	0.020
6.000	3.368	-0.002	-0.329	3.384	3.332	0.000	-0.320	3.347	-0.037	0.002	0.000	0.037
8.000	6.010	-0.010	-0.534	6.034	5.944	-0.002	-0.519	5.967	-0.067	0.008	0.000	0.068
10.000	9.392	-0.024	-0.792	9.425	9.275	-0.005	-0.764	9.307	-0.120	0.019	0.000	0.121
12.000	13.502	-0.048	-1.096	13.546	13.296	-0.010	-1.048	13.338	-0.211	0.038	0.000	0.214
14.000	18.360	-0.073	-1.462	18.418	18.037	-0.016	-1.386	18.090	-0.332	0.057	0.000	0.336
16.000	23.966	-0.096	-1.885	24.040	23.526	-0.022	-1.782	23.593	-0.452	0.074	-0.001	0.458
18.000	30.318	-0.118	-2.369	30.411	29.761	-0.028	-2.239	29.845	-0.572	0.090	-0.001	0.579
20.000	37.426	-0.138	-2.913	37.539	36.747	-0.034	-2.754	36.851	-0.697	0.104	-0.001	0.704
22.000	45.254	-0.173	-3.495	45.389	44.477	-0.043	-3.312	44.601	-0.798	0.130	-0.001	0.808
24.000	53.624	-0.222	-4.417	53.806	52.814	-0.157	-4.225	52.983	-0.832	0.065	-0.001	0.835
26.000	62.779	-0.294	-5.297	63.002	61.919	-0.307	-5.089	62.128	-0.885	-0.012	0.003	0.885
28.000	72.709	-0.176	-6.137	72.968	71.793	-0.419	-5.907	72.037	-0.945	-0.242	0.010	0.975
30.000	83.404	0.352	-6.915	83.690	82.451	-0.398	-6.666	82.721	-0.986	-0.749	0.019	1.238
32.000	94.080	0.535	-7.240	94.360	93.727	-0.423	-7.110	93.997	-0.376	-0.957	0.041	1.029
34.000	104.889	0.071	-7.234	105.138	105.604	-0.633	-7.306	105.859	0.710	-0.706	0.097	1.006
36.000	116.510	-0.408	-7.277	116.737	118.233	-0.984	-7.495	118.474	1.722	-0.585	0.197	1.830
38.000	127.722	-1.024	-7.102	127.923	131.306	-1.474	-7.573	131.533	3.590	-0.474	0.404	3.643
40.000	139.233	-1.201	-6.715	139.400	145.087	-1.867	-7.440	145.290	5.849	-0.719	0.720	5.937
42.000	149.450	-0.660	-6.479	149.592	158.571	-2.237	-7.528	158.765	9.079	-1.685	1.225	9.315
44.000	155.812	-0.836	-4.740	155.887	170.774	-2.712	-6.337	170.913	14.855	-2.106	2.198	15.163
46.000	157.720	-3.088	-1.115	157.754	181.675	-3.707	-3.283	181.743	23.690	-1.112	4.061	24.061
48.000	156.096	-4.584	3.913	156.213	191.901	-4.378	0.957	191.953	35.308	-0.762	6.593	35.927
50.000	141.126	-13.942	16.832	142.808	199.739	-6.638	13.452	200.301	57.525	5.185	12.814	59.163
52.000	122.195	-24.412	32.266	128.719	206.670	-9.011	29.910	209.017	82.311	11.324	21.803	85.900
54.000	94.373	-38.752	54.224	115.535	211.079	-12.280	56.971	218.976	112.157	18.960	37.279	119.701
56.000	63.940	-52.830	78.311	114.069	213.707	-16.371	91.124	232.899	141.171	23.677	58.599	154.673
58.000	27.937	-68.681	99.258	123.894	214.085	-21.715	126.806	249.767	171.680	26.531	86.244	193.948
60.000	-48.785	-89.387	132.584	167.178	209.556	-25.937	169.668	270.875	238.362	28.911	120.368	268.591
62.000	-77.547	-101.219	145.352	193.355	203.606	-30.570	209.855	293.988	252.303	25.298	154.604	296.984
64.000	-88.016	-107.303	145.939	201.393	199.040	-34.244	238.403	312.451	249.362	19.440	183.655	310.304
66.000	-87.056	-109.586	135.436	194.758	196.297	-37.048	254.173	323.279	237.429	13.587	207.586	315.673
68.000	-81.208	-110.824	115.623	179.570	193.532	-39.896	261.153	327.486	220.628	9.256	230.063	318.891
70.000	-73.848	-112.242	90.482	161.984	189.212	-43.176	264.497	328.061	200.518	6.746	252.981	322.881
72.000	-68.106	-113.520	68.202	148.919	183.289	-46.872	268.296	328.290	181.488	4.619	273.349	328.145
74.000	-67.903	-114.780	45.146	140.795	177.090	-50.470	271.958	328.435	167.908	1.761	295.644	340.002
76.000	-74.122	-116.052	20.340	139.197	166.505	-55.141	276.104	327.105	156.313	-2.407	320.292	356.408
78.000	-83.506	-116.413	-2.649	143.291	150.797	-61.731	281.259	325.049	143.815	-8.988	343.115	372.145
80.000	-90.414	-115.111	-20.631	147.820	130.393	-69.834	287.803	323.589	126.450	-16.916	360.086	382.017

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
PAGE: 23.01
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

POINT REL. LINEAR DISPLACEMENT (IN.)

TIME	POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 3 - UT IN VEH REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN VEH REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 5 - H IN UT REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	11.314	0.000	-26.938	29.217	7.775	0.000	-41.833	42.550	-0.022	0.000	-15.310	15.310
2.000	11.314	0.000	-26.938	29.218	7.775	0.000	-41.833	42.550	-0.022	0.000	-15.310	15.310
4.000	11.316	0.000	-26.938	29.218	7.777	0.000	-41.834	42.550	-0.022	0.000	-15.310	15.310
6.000	11.320	0.000	-26.939	29.221	7.782	0.000	-41.834	42.552	-0.023	0.000	-15.310	15.310
8.000	11.330	0.000	-26.940	29.225	7.791	0.000	-41.835	42.554	-0.023	0.000	-15.310	15.310
10.000	11.345	0.000	-26.941	29.232	7.806	0.000	-41.836	42.558	-0.022	0.000	-15.310	15.310
12.000	11.368	0.000	-26.943	29.243	7.828	0.000	-41.838	42.564	-0.022	0.000	-15.310	15.310
14.000	11.400	0.000	-26.945	29.257	7.860	0.000	-41.840	42.572	-0.021	0.000	-15.310	15.310
16.000	11.442	0.000	-26.949	29.277	7.901	0.000	-41.844	42.583	-0.020	0.001	-15.310	15.310
18.000	11.496	-0.001	-26.953	29.302	7.954	0.000	-41.848	42.597	-0.017	0.001	-15.310	15.310
20.000	11.564	-0.001	-26.958	29.334	8.021	0.000	-41.853	42.614	-0.015	0.001	-15.310	15.310
22.000	11.646	-0.001	-26.965	29.372	8.102	0.000	-41.859	42.636	-0.011	0.002	-15.310	15.310
24.000	11.745	-0.002	-26.972	29.419	8.199	0.000	-41.866	42.661	-0.005	0.004	-15.310	15.310
26.000	11.861	-0.002	-26.982	29.474	8.314	-0.001	-41.876	42.693	0.003	0.008	-15.310	15.310
28.000	11.996	-0.003	-26.994	29.539	8.447	-0.002	-41.887	42.730	0.014	0.016	-15.310	15.310
30.000	12.152	-0.003	-27.007	29.615	8.601	-0.003	-41.899	42.773	0.027	0.024	-15.310	15.310
32.000	12.330	-0.001	-27.021	29.701	8.777	-0.003	-41.913	42.822	0.044	0.032	-15.310	15.310
34.000	12.529	-0.001	-27.036	29.798	8.977	-0.004	-41.928	42.878	0.069	0.042	-15.310	15.310
36.000	12.750	-0.001	-27.050	29.905	9.200	-0.006	-41.943	42.940	0.102	0.058	-15.309	15.309
38.000	12.995	-0.003	-27.065	30.023	9.450	-0.008	-41.958	43.009	0.147	0.081	-15.308	15.309
40.000	13.262	-0.005	-27.079	30.152	9.726	-0.012	-41.973	43.085	0.206	0.112	-15.306	15.308
42.000	13.551	-0.007	-27.092	30.292	10.030	-0.016	-41.988	43.169	0.279	0.149	-15.303	15.306
44.000	13.857	-0.007	-27.104	30.441	10.360	-0.021	-42.002	43.261	0.371	0.191	-15.298	15.303
46.000	14.171	-0.011	-27.110	30.590	10.712	-0.027	-42.012	43.356	0.499	0.245	-15.288	15.298
48.000	14.486	-0.019	-27.107	30.735	11.086	-0.035	-42.014	43.452	0.659	0.307	-15.273	15.290
50.000	14.784	-0.037	-27.087	30.859	11.478	-0.046	-42.001	43.541	0.868	0.380	-15.247	15.276
52.000	15.048	-0.075	-27.039	30.944	11.884	-0.062	-41.958	43.609	1.144	0.470	-15.201	15.252
54.000	15.266	-0.138	-26.953	30.976	12.302	-0.083	-41.873	43.643	1.497	0.561	-15.128	15.212
56.000	15.424	-0.230	-26.821	30.940	12.727	-0.111	-41.726	43.624	1.939	0.645	-15.010	15.148
58.000	15.520	-0.349	-26.641	30.834	13.156	-0.149	-41.507	43.543	2.449	0.714	-14.836	15.054
60.000	15.493	-0.507	-26.412	30.624	13.579	-0.197	-41.214	43.394	2.991	0.751	-14.606	14.928
62.000	15.361	-0.699	-26.130	30.319	13.993	-0.253	-40.832	43.164	3.548	0.697	-14.323	14.772
64.000	15.193	-0.909	-25.837	29.987	14.395	-0.318	-40.382	42.872	4.108	0.585	-13.976	14.579
66.000	15.017	-1.126	-25.554	29.661	14.790	-0.390	-39.887	42.543	4.633	0.439	-13.579	14.354
68.000	14.848	-1.347	-25.302	29.368	15.180	-0.466	-39.371	42.199	5.107	0.285	-13.141	14.101
70.000	14.693	-1.569	-25.096	29.123	15.563	-0.549	-38.845	41.851	5.528	0.131	-12.660	13.815
72.000	14.552	-1.795	-24.938	28.929	15.936	-0.639	-38.313	41.500	5.887	-0.018	-12.144	13.496
74.000	14.417	-2.024	-24.824	28.778	16.297	-0.737	-37.772	41.145	6.179	-0.156	-11.604	13.147
76.000	14.275	-2.255	-24.759	28.668	16.641	-0.842	-37.225	40.784	6.409	-0.281	-11.038	12.767
78.000	14.118	-2.487	-24.742	28.595	16.959	-0.959	-36.667	40.411	6.577	-0.392	-10.451	12.355
80.000	13.944	-2.719	-24.766	28.551	17.242	-1.090	-36.098	40.019	6.684	-0.491	-9.851	11.915

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT ANGULAR ACCELERATION (REV/SEC.**2)

TIME	SEGMENT NO. 3 - UT IN UT REFERENCE				SEGMENT NO. 5 - H IN H REFERENCE				SEGMENT NO. 5 - H IN VEH REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	-0.137	0.000	0.137	0.000	-0.185	0.000	0.185	0.000	-0.185	0.000	0.185
2.000	0.001	-0.042	0.002	0.043	-0.001	-0.052	0.000	0.052	-0.001	-0.052	0.000	0.052
4.000	0.006	0.040	0.015	0.043	-0.006	-0.067	0.000	0.067	-0.006	-0.067	0.002	0.067
6.000	-0.004	0.247	0.049	0.252	0.021	-0.177	-0.001	0.178	0.020	-0.177	-0.005	0.178
8.000	-0.039	0.665	0.129	0.678	0.107	-0.365	-0.002	0.380	0.104	-0.365	-0.027	0.380
10.000	-0.080	1.188	0.277	1.223	0.221	-0.482	0.002	0.530	0.215	-0.482	-0.050	0.530
12.000	-0.118	1.611	0.416	1.669	0.332	-0.264	0.016	0.424	0.326	-0.264	-0.062	0.424
14.000	-0.083	1.943	0.457	1.997	0.283	-0.730	0.029	0.784	0.282	-0.730	-0.038	0.784
16.000	-0.087	2.460	0.635	2.542	0.302	-1.430	0.043	1.462	0.303	-1.430	-0.029	1.462
18.000	0.008	2.589	0.664	2.673	0.141	-1.610	0.060	1.617	0.151	-1.610	0.026	1.617
20.000	0.037	2.973	0.948	3.120	0.102	-2.115	0.080	2.119	0.118	-2.115	0.054	2.119
22.000	-0.010	3.607	1.429	3.879	0.244	-3.094	0.108	3.106	0.262	-3.094	0.048	3.106
24.000	-8.600	7.157	4.790	12.171	7.768	-7.307	0.183	10.666	7.598	-7.307	-1.626	10.666
26.000	-9.914	7.450	4.950	13.353	10.014	-8.144	0.309	12.911	9.812	-8.143	-2.022	12.911
28.000	-1.602	6.837	5.335	8.819	0.731	-7.928	0.450	7.974	0.814	-7.928	0.260	7.974
30.000	-2.418	7.045	5.092	9.072	-1.971	-8.546	0.594	8.791	-1.785	-8.548	1.017	8.791
32.000	-5.518	18.566	11.214	22.381	8.491	-29.792	0.788	30.988	8.434	-29.793	-1.243	30.988
34.000	-5.789	14.342	10.997	18.977	8.985	-28.116	1.107	29.537	8.988	-28.117	-1.045	29.537
36.000	-10.236	20.115	12.679	25.887	15.101	-38.011	1.455	40.927	15.018	-38.013	-2.127	40.927
38.000	-27.100	26.891	17.134	41.846	30.178	-51.830	1.903	60.006	29.806	-51.828	-5.111	60.006
40.000	-22.699	24.663	16.092	37.182	22.068	-57.722	2.414	61.843	21.998	-57.727	-2.878	61.843
42.000	-30.498	28.252	24.219	48.113	21.827	-71.925	2.986	75.223	21.854	-71.937	-2.442	75.223
44.000	-32.187	56.105	49.690	81.565	50.733	-136.186	3.903	145.381	50.213	-136.179	-8.335	145.381
46.000	-28.042	37.572	48.859	67.714	44.955	-148.639	5.635	155.391	44.854	-148.665	-5.761	155.391
48.000	-20.702	-4.036	40.577	45.731	24.155	-149.938	7.474	152.055	24.678	-150.038	-0.423	152.055
50.000	-48.385	37.032	81.432	101.704	139.703	-302.280	11.206	333.190	138.788	-302.255	-19.874	333.190
52.000	20.899	8.412	77.489	80.698	86.870	-320.679	15.481	332.598	87.017	-320.899	-8.573	332.598
54.000	21.075	54.615	169.909	179.711	120.265	-438.481	21.646	455.190	120.241	-438.852	-12.223	455.190
56.000	15.799	22.276	164.884	167.130	113.182	-428.843	29.299	444.494	113.279	-429.795	-4.359	444.494
58.000	-70.850	-73.615	-213.885	237.035	205.076	-427.000	36.749	475.117	204.444	-428.864	3.808	475.117
60.000	213.357	-282.895	320.674	477.894	-54.947	-386.330	39.469	392.208	-56.394	-388.083	-6.237	392.208
62.000	88.426	-23.362	27.240	95.430	-20.082	-300.005	42.593	303.679	-23.448	-302.770	1.119	303.679
64.000	44.445	-34.608	-63.285	84.723	-20.168	-163.484	40.696	169.676	-26.390	-147.272	10.665	169.676
66.000	-14.123	-63.981	-141.182	155.645	35.355	-125.898	37.342	135.996	24.564	-131.014	26.957	135.996
68.000	-37.438	-24.558	-71.335	84.222	82.975	-179.967	36.180	201.450	67.795	-186.059	36.984	201.450
70.000	-38.031	-65.178	-38.947	84.920	90.968	-166.521	37.777	193.473	68.935	-174.339	47.809	193.473
72.000	-58.153	-115.779	-40.978	135.889	65.468	-76.947	39.363	108.427	34.892	-86.935	54.600	108.427
74.000	-73.956	-128.701	-33.634	152.200	71.790	-104.065	35.913	131.427	39.042	-114.114	52.218	131.427
76.000	-108.913	-153.734	-12.238	188.802	85.877	-134.273	35.927	163.386	46.823	-145.589	57.501	163.386
78.000	-133.289	-152.796	3.154	202.787	80.966	-120.334	37.667	149.849	34.375	-133.462	58.829	149.849
80.000	-132.606	-117.860	3.936	177.457	51.234	-55.968	40.143	85.842	-0.345	-70.727	48.645	85.842

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT REL. ANGULAR VELOCITY (REV/SEC.)

TIME	SEGMENT NO. 3 - UT IN VEH REFERENCE				SEGMENT NO. 5 - H IN VEH REFERENCE				SEGMENT NO. 5 - H IN H REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.001	0.000	-0.001	0.000	0.001
8.000	0.000	0.001	0.000	0.001	0.000	-0.001	0.000	0.001	0.000	-0.001	0.000	0.001
10.000	0.000	0.003	0.001	0.003	0.001	-0.002	0.000	0.002	0.001	-0.002	0.000	0.002
12.000	0.000	0.006	0.002	0.006	0.001	-0.003	0.000	0.003	0.001	-0.003	0.000	0.003
14.000	0.000	0.009	0.003	0.010	0.002	-0.004	0.000	0.004	0.002	-0.004	0.000	0.004
16.000	0.000	0.014	0.004	0.014	0.002	-0.006	0.000	0.006	0.002	-0.006	0.000	0.006
18.000	0.000	0.019	0.005	0.019	0.003	-0.009	0.000	0.009	0.003	-0.009	0.000	0.009
20.000	0.000	0.024	0.006	0.025	0.004	-0.013	0.000	0.013	0.004	-0.013	0.000	0.013
22.000	0.001	0.031	0.009	0.032	0.005	-0.018	-0.001	0.019	0.005	-0.018	0.001	0.019
24.000	-0.012	0.044	0.021	0.050	0.016	-0.031	-0.003	0.035	0.017	-0.031	0.001	0.035
26.000	-0.026	0.058	0.033	0.072	0.033	-0.046	-0.007	0.057	0.034	-0.046	0.001	0.057
28.000	-0.036	0.072	0.046	0.093	0.046	-0.062	-0.009	0.077	0.047	-0.062	0.002	0.077
30.000	-0.036	0.085	0.055	0.108	0.044	-0.078	-0.007	0.089	0.044	-0.078	0.003	0.089
32.000	-0.037	0.112	0.075	0.139	0.045	-0.114	-0.006	0.123	0.045	-0.114	0.004	0.123
34.000	-0.049	0.146	0.102	0.185	0.067	-0.174	-0.010	0.187	0.067	-0.174	0.006	0.187
36.000	-0.076	0.180	0.132	0.236	0.105	-0.236	-0.016	0.258	0.106	-0.236	0.009	0.258
38.000	-0.114	0.231	0.174	0.311	0.158	-0.331	-0.025	0.367	0.159	-0.331	0.012	0.367
40.000	-0.139	0.277	0.212	0.376	0.200	-0.436	-0.031	0.481	0.202	-0.436	0.017	0.481
42.000	-0.172	0.326	0.260	0.452	0.239	-0.565	-0.035	0.614	0.240	-0.565	0.022	0.614
44.000	-0.196	0.409	0.348	0.571	0.285	-0.766	-0.041	0.818	0.287	-0.766	0.029	0.818
46.000	-0.235	0.504	0.469	0.728	0.385	-1.056	-0.056	1.125	0.388	-1.056	0.038	1.125
48.000	-0.229	0.530	0.567	0.809	0.447	-1.355	-0.060	1.428	0.449	-1.355	0.051	1.428
50.000	-0.241	0.669	0.811	1.079	0.652	-1.933	-0.092	2.042	0.655	-1.933	0.069	2.042
52.000	-0.192	0.728	0.993	1.246	0.850	-2.558	-0.116	2.698	0.854	-2.558	0.096	2.698
54.000	-0.059	0.902	1.343	1.618	1.071	-3.411	-0.144	3.578	1.075	-3.411	0.132	3.578
56.000	0.073	1.021	1.706	1.989	1.296	-4.299	-0.161	4.493	1.300	-4.297	0.183	4.493
58.000	0.050	0.985	1.756	2.014	1.581	-5.149	-0.162	5.389	1.586	-5.144	0.249	5.389
60.000	0.638	0.350	2.155	2.274	1.585	-6.117	-0.179	6.321	1.591	-6.109	0.325	6.321
62.000	0.889	0.383	2.284	2.480	1.553	-6.864	-0.186	7.040	1.563	-6.852	0.408	7.040
64.000	0.999	0.342	2.217	2.456	1.491	-7.290	-0.171	7.443	1.512	-7.271	0.492	7.443
66.000	0.984	0.240	2.039	2.276	1.477	-7.552	-0.134	7.696	1.514	-7.524	0.570	7.696
68.000	0.901	0.147	1.885	2.095	1.563	-7.860	-0.072	8.014	1.626	-7.821	0.642	8.014
70.000	0.823	0.060	1.817	1.996	1.708	-8.236	0.012	8.412	1.807	-8.184	0.716	8.412
72.000	0.766	-0.148	1.772	1.936	1.824	-8.529	0.116	8.722	1.975	-8.458	0.794	8.722
74.000	0.692	-0.414	1.729	1.908	1.879	-8.677	0.222	8.881	2.095	-8.586	0.868	8.881
76.000	0.606	-0.733	1.717	1.963	1.971	-8.960	0.328	9.180	2.256	-8.849	0.939	9.180
78.000	0.491	-1.104	1.763	2.138	2.058	-9.256	0.445	9.492	2.428	-9.120	1.013	9.492
80.000	0.353	-1.429	1.829	2.347	2.089	-9.448	0.553	9.692	2.557	-9.285	1.090	9.692

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT REL. ANGULAR DISPLACEMENT (DEG)

TIME	SEGMENT NO. 3 - UT IN VEH REFERENCE				SEGMENT NO. 5 - H IN VEH REFERENCE				SEGMENT NO. 5 - H IN UT REFERENCE			
(MSEC)	YAW	PITCH	ROLL	RES	YAW	PITCH	ROLL	RES	YAW	PITCH	ROLL	RES
0.000	0.000	13.280	0.000	13.280	0.000	13.460	0.000	13.460	0.000	0.180	0.000	0.180
2.000	0.000	13.280	0.000	13.280	0.000	13.460	0.000	13.460	0.000	0.180	0.000	0.180
4.000	0.000	13.280	0.000	13.280	0.000	13.460	0.000	13.460	0.000	0.180	0.000	0.180
6.000	0.000	13.280	0.000	13.280	0.000	13.459	0.000	13.459	0.000	0.180	0.000	0.180
8.000	0.000	13.280	0.000	13.280	0.000	13.459	0.000	13.459	0.000	0.179	0.000	0.179
10.000	0.001	13.281	0.000	13.281	0.000	13.458	0.000	13.458	-0.001	0.176	0.000	0.176
12.000	0.001	13.284	0.000	13.284	0.000	13.456	0.001	13.456	-0.001	0.171	0.001	0.172
14.000	0.003	13.290	0.000	13.290	0.000	13.454	0.002	13.454	-0.003	0.164	0.003	0.164
16.000	0.005	13.298	0.000	13.298	0.000	13.450	0.003	13.450	-0.005	0.152	0.005	0.152
18.000	0.008	13.310	0.000	13.310	0.000	13.445	0.005	13.445	-0.008	0.135	0.007	0.136
20.000	0.012	13.325	0.000	13.325	0.000	13.437	0.008	13.437	-0.011	0.112	0.010	0.113
22.000	0.018	13.345	0.001	13.345	0.001	13.426	0.011	13.426	-0.016	0.081	0.014	0.084
24.000	0.027	13.372	-0.003	13.372	0.001	13.409	0.018	13.409	-0.025	0.037	0.027	0.052
26.000	0.043	13.409	-0.017	13.409	0.002	13.381	0.036	13.382	-0.040	-0.027	0.063	0.079
28.000	0.067	13.456	-0.042	13.456	0.003	13.343	0.067	13.343	-0.062	-0.113	0.124	0.179
30.000	0.097	13.513	-0.069	13.513	0.005	13.293	0.101	13.293	-0.089	-0.220	0.191	0.305
32.000	0.136	13.582	-0.095	13.583	0.008	13.227	0.132	13.228	-0.126	-0.354	0.257	0.455
34.000	0.193	13.675	-0.127	13.677	0.011	13.123	0.173	13.124	-0.178	-0.552	0.343	0.673
36.000	0.265	13.791	-0.175	13.795	0.017	12.978	0.237	12.980	-0.245	-0.813	0.471	0.970
38.000	0.359	13.939	-0.243	13.946	0.023	12.775	0.333	12.779	-0.332	-1.162	0.657	1.374
40.000	0.476	14.123	-0.336	14.136	0.032	12.500	0.466	12.508	-0.443	-1.620	0.910	1.907
42.000	0.617	14.341	-0.449	14.364	0.042	12.140	0.628	12.156	-0.579	-2.196	1.220	2.572
44.000	0.797	14.601	-0.582	14.638	0.055	11.672	0.813	11.700	-0.757	-2.920	1.583	3.398
46.000	1.052	14.935	-0.739	14.997	0.068	11.017	1.061	11.067	-1.018	-3.903	2.055	4.511
48.000	1.383	15.315	-0.905	15.414	0.082	10.149	1.367	10.240	-1.367	-5.141	2.620	5.902
50.000	1.837	15.754	-1.063	15.912	0.093	8.975	1.755	9.144	-1.860	-6.738	3.301	7.683
52.000	2.445	16.263	-1.213	16.515	0.095	7.361	2.304	7.712	-2.548	-8.837	4.197	10.024
54.000	3.262	16.853	-1.279	17.247	0.077	5.221	2.994	6.017	-3.499	-11.531	5.240	12.994
56.000	4.376	17.548	-1.225	18.167	0.024	2.443	3.846	4.556	-4.830	-14.954	6.468	16.740
58.000	5.730	18.282	-1.076	19.232	-0.080	-0.956	4.867	4.960	-6.520	-19.021	7.925	21.188
60.000	7.198	18.725	-0.796	20.112	-0.263	-5.032	6.043	7.858	-8.457	-23.473	9.510	26.030
62.000	9.010	18.894	-0.167	20.927	-0.545	-9.713	7.216	12.079	-10.799	-28.287	10.903	31.183
64.000	10.887	19.035	0.596	21.863	-0.927	-14.811	8.405	16.984	-13.329	-33.526	12.297	36.700
66.000	12.684	19.097	1.389	22.806	-1.407	-20.134	9.632	22.235	-15.925	-38.944	13.770	42.339
68.000	14.326	19.070	2.120	23.692	-2.012	-25.641	10.994	27.755	-18.620	-44.470	15.523	48.056
70.000	15.868	18.985	2.772	24.554	-2.808	-31.383	12.610	33.588	-21.668	-50.163	17.827	53.960
72.000	17.346	18.800	3.344	25.369	-3.876	-37.343	14.579	39.712	-25.358	-55.941	20.942	60.003
74.000	18.753	18.447	3.806	26.080	-5.305	-43.404	16.970	46.004	-30.054	-61.584	25.198	66.009
76.000	20.091	17.906	4.127	26.679	-7.292	-49.559	19.979	52.473	-36.534	-66.989	31.360	71.966
78.000	21.384	17.148	4.271	27.175	-10.213	-55.825	23.994	59.178	-46.425	-71.980	41.030	77.911
80.000	22.660	16.188	4.207	27.614	-14.704	-62.089	29.648	66.073	-62.537	-76.081	56.973	83.815

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

JOINT PARAMETERS

	JOINT NO. 3 - NP							JOINT NO. 4 - HP						
TIME	STATE	JOINT ANGLES (DEG)			TOTAL TORQUE (IN. LB.)			STATE	JOINT ANGLES (DEG)			TOTAL TORQUE (IN. LB.)		
(MSEC)	IPIN	FLEXURE	AZIMUTH	TORSION	SPRING	VISCOUS	RES.	IPIN	FLEXURE	AZIMUTH	TORSION	SPRING	VISCOUS	RES.
0.000	0.	10.180	0.000	0.000	0.000	0.000	0.000	0.	10.000	0.000	0.000	0.000	0.000	0.000
2.000	0.	10.181	0.000	0.000	0.000	0.118	0.118	0.	9.999	0.000	0.000	0.000	0.118	0.118
4.000	0.	10.184	0.000	0.000	0.000	0.190	0.190	0.	9.996	0.000	0.000	0.000	0.194	0.194
6.000	0.	10.189	0.000	0.000	0.000	0.241	0.241	0.	9.991	0.000	0.000	0.000	0.263	0.263
8.000	0.	10.194	-0.001	0.000	0.000	0.224	0.224	0.	9.985	0.001	0.000	0.000	0.303	0.303
10.000	0.	10.197	-0.005	0.000	0.000	0.115	0.115	0.	9.979	0.002	0.000	0.000	0.284	0.284
12.000	0.	10.197	-0.013	-0.001	0.000	0.166	0.166	0.	9.974	0.005	0.000	0.000	0.187	0.187
14.000	0.	10.192	-0.026	-0.002	0.000	0.401	0.401	0.	9.971	0.009	-0.001	0.000	0.112	0.112
16.000	0.	10.182	-0.042	-0.003	0.000	0.680	0.680	0.	9.970	0.012	-0.002	0.000	0.069	0.069
18.000	0.	10.166	-0.061	-0.004	0.000	0.977	0.977	0.	9.969	0.013	-0.003	0.000	0.072	0.072
20.000	0.	10.144	-0.081	-0.006	0.000	1.281	1.281	0.	9.968	0.012	-0.004	0.000	0.104	0.104
22.000	0.	10.115	-0.104	-0.009	0.000	1.728	1.728	0.	9.967	0.009	-0.006	0.000	0.122	0.122
24.000	0.	10.068	-0.222	-0.013	0.000	3.586	3.586	0.	9.970	0.046	-0.009	0.000	0.771	0.771
26.000	0.	9.997	-0.530	-0.019	0.000	5.256	5.256	0.	9.977	0.134	-0.016	0.000	0.981	0.981
28.000	0.	9.907	-0.984	-0.026	0.000	6.009	6.009	0.	9.981	0.211	-0.024	0.000	0.458	0.458
30.000	0.	9.805	-1.332	-0.039	0.000	6.012	6.012	0.	9.978	0.136	-0.034	0.000	1.331	1.331
32.000	0.	9.671	-1.592	-0.058	0.000	9.657	9.657	0.	9.978	-0.039	-0.045	0.000	1.704	1.704
34.000	0.	9.440	-2.129	-0.084	0.000	14.463	14.463	0.	10.014	-0.105	-0.062	0.000	2.267	2.267
36.000	0.	9.152	-3.083	-0.113	0.000	18.782	18.782	0.	10.046	-0.075	-0.088	0.000	2.371	2.371
38.000	0.	8.767	-4.576	-0.147	0.000	26.352	26.352	0.	10.095	-0.005	-0.122	0.000	3.606	3.606
40.000	0.	8.280	-6.692	-0.188	0.000	31.362	31.362	0.	10.149	0.007	-0.163	0.000	3.348	3.348
42.000	0.	7.699	-9.366	-0.240	0.000	37.757	37.757	0.	10.197	-0.171	-0.212	0.000	4.202	4.202
44.000	0.	6.972	-12.870	-0.317	0.000	52.652	52.652	0.	10.265	-0.573	-0.269	0.000	7.887	7.887
46.000	0.	5.966	-19.595	-0.430	0.000	71.325	71.325	0.	10.445	-0.726	-0.352	0.000	11.132	11.132
48.000	0.	4.869	-30.859	-0.581	0.000	80.360	80.360	0.	10.627	-1.060	-0.464	0.000	10.999	10.999
50.000	0.	3.822	-54.577	-0.804	0.000	125.388	125.388	0.	10.957	-1.213	-0.617	0.000	25.143	25.143
52.000	0.	4.001	-95.947	-1.088	0.000	150.487	150.487	0.	11.421	-0.891	-0.839	0.000	25.934	25.934
54.000	0.	6.124	-127.683	-1.502	0.000	193.882	193.882	0.	11.949	-0.784	-1.122	0.000	32.618	32.618
56.000	0.	9.668	-143.883	-2.084	0.000	220.529	220.529	0.	12.423	-0.721	-1.497	0.000	27.056	27.056
58.000	0.	13.878	-152.083	-2.748	0.000	235.094	235.094	0.	12.563	-0.690	-1.964	0.000	26.095	26.095
60.000	0.	18.379	-157.625	-3.482	0.000	234.042	234.042	0.	12.544	-1.090	-2.446	0.000	28.518	28.518
62.000	0.	22.709	-162.883	-4.505	0.000	238.449	238.449	0.	12.127	-2.354	-2.954	0.000	43.769	43.769
64.000	0.	26.899	-167.023	-5.484	18.036	216.552	233.247	0.	11.096	-3.358	-3.457	0.000	73.428	73.428
66.000	0.	30.558	-170.082	-6.297	154.456	176.484	324.673	0.	9.293	-4.188	-3.894	0.000	115.796	115.796
68.000	0.	33.331	-172.228	-6.882	347.062	123.565	462.542	0.	6.439	-6.114	-4.250	0.000	175.281	175.281
70.000	0.	35.027	-173.783	-7.296	502.714	67.615	559.233	0.	2.361	-19.607	-4.534	0.000	244.357	244.357
72.000	0.	35.552	-174.978	-7.592	493.636	30.690	494.729	0.	3.448	-162.475	-4.760	0.000	303.225	303.225
74.000	0.	35.540	-175.910	-7.807	466.062	24.286	466.652	0.	9.415	-172.198	-4.909	0.000	300.392	300.392
76.000	0.	35.544	-176.681	-7.960	539.760	20.915	540.627	0.	15.394	-174.585	-4.988	0.000	299.780	299.780
78.000	0.	35.568	-177.364	-8.079	558.450	19.211	561.920	0.	21.358	-175.662	-5.027	0.000	295.975	295.975
80.000	0.	35.764	-178.027	-8.198	579.271	26.658	596.493	0.	27.109	-176.275	-5.046	22.243	278.693	300.921

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

HP JOINT FORCES & TORQUES ON H IN H REFERENCE

TIME	JOINT FORCE (LB. 10**2)			JOINT TORQUE (IN.- LB. 10**2)		
(MSEC)	X	Y	Z	X	Y	Z
0.000	0.000	0.000	-0.126	0.000D+00	0.000D+00	0.000D+00
2.000	0.000	0.000	-0.129	-0.119D-06	0.118D-02	0.232D-07
4.000	0.001	0.000	-0.136	-0.939D-07	0.194D-02	0.765D-06
6.000	0.002	0.000	-0.142	0.273D-04	0.263D-02	0.587D-05
8.000	0.002	0.000	-0.148	0.116D-03	0.303D-02	0.258D-04
10.000	0.001	-0.001	-0.158	0.238D-03	0.283D-02	0.725D-04
12.000	-0.001	-0.001	-0.171	0.385D-03	0.183D-02	0.160D-03
14.000	-0.003	-0.001	-0.181	0.383D-03	0.101D-02	0.284D-03
16.000	-0.005	-0.001	-0.190	0.297D-03	0.458D-03	0.427D-03
18.000	-0.005	0.000	-0.202	0.148D-03	0.370D-03	0.601D-03
20.000	-0.007	0.000	-0.210	0.503D-05	0.665D-03	0.800D-03
22.000	-0.010	-0.001	-0.218	0.670D-04	0.574D-03	0.107D-02
24.000	-0.024	-0.021	-0.273	0.675D-02	-0.325D-02	0.181D-02
26.000	-0.027	-0.028	-0.270	0.883D-02	-0.301D-02	0.305D-02
28.000	-0.026	-0.002	-0.254	0.106D-02	-0.444D-03	0.444D-02
30.000	-0.029	0.004	-0.263	-0.115D-01	0.330D-02	0.586D-02
32.000	-0.097	-0.027	-0.164	-0.105D-01	-0.109D-01	0.776D-02
34.000	-0.090	-0.026	-0.153	-0.180D-02	-0.198D-01	0.108D-01
36.000	-0.123	-0.043	-0.131	0.560D-02	-0.182D-01	0.141D-01
38.000	-0.167	-0.086	-0.217	0.121D-01	-0.287D-01	0.182D-01
40.000	-0.187	-0.065	-0.200	-0.435D-02	-0.242D-01	0.227D-01
42.000	-0.235	-0.067	-0.280	-0.207D-01	-0.239D-01	0.277D-01
44.000	0.440	-0.151	0.231	-0.200D-01	-0.675D-01	0.356D-01
46.000	-0.476	-0.133	0.180	-0.666D-02	-0.992D-01	0.500D-01
48.000	-0.484	-0.078	0.423	-0.409D-01	-0.785D-01	0.653D-01
50.000	-0.964	-0.400	1.929	0.475D-01	-0.229D+00	0.927D-01
52.000	-1.025	-0.250	2.650	0.333D-01	-0.227D+00	0.122D+00
54.000	-1.406	-0.348	4.626	0.417D-01	-0.281D+00	0.161D+00
56.000	-1.393	-0.331	5.514	0.379D-01	-0.168D+00	0.208D+00
58.000	-1.416	-0.595	5.141	0.910D-01	0.106D-01	0.244D+00
60.000	-1.296	0.123	7.496	-0.979D-01	0.101D+00	0.248D+00
62.000	-1.049	0.016	5.739	-0.807D-01	0.339D+00	0.264D+00
64.000	-0.656	0.016	3.853	-0.406D-01	0.692D+00	0.241D+00
66.000	-0.606	-0.153	1.823	-0.400D-01	0.114D+01	0.202D+00
68.000	-0.887	-0.314	1.048	-0.123D+00	0.174D+01	0.171D+00
70.000	-0.958	-0.369	1.210	-0.259D+00	0.242D+01	0.156D+00
72.000	-0.758	-0.324	1.329	-0.380D+00	0.300D+01	0.143D+00
74.000	-0.842	-0.344	1.491	-0.344D+00	0.298D+01	0.897D-01
76.000	-0.939	-0.393	2.383	-0.340D+00	0.298D+01	0.605D-01
78.000	-0.884	-0.387	3.033	-0.337D+00	0.294D+01	0.453D-01
80.000	-0.676	-0.312	3.738	-0.352D+00	0.299D+01	0.461D-01

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

PAGE: 29.01

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

BODY PROPERTIES - REFERENCE SEGMENT NO. 16 (VEH)

INCLUDED SEGMENT NOS: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

TIME	CENTER OF GRAVITY (IN.)			LINEAR MOMENTUM (LB.-SEC.)			ANGULAR MOMENTUM (IN.- LB.-SEC.)			KINETIC ENERGY (LB.- IN.)		
(MSEC)	X	Y	Z	X	Y	Z	X	Y	Z	LINEAR	ANGULAR	TOTAL
0.000	18.183	0.000	-20.231	0.000D+00	0.000D+00	0.000D+00	0.000D+00	0.000D+00	0.000D+00	0.000D+00	0.000D+00	0.000D+00
2.000	18.183	0.000	-20.231	-0.252D-01	0.287D-06	0.723D-04	-0.699D-04	0.197D-01	0.304D-03	0.382D-01	0.495D-02	0.431D-01
4.000	18.185	0.000	-20.231	-0.121D+00	-0.220D-04	-0.665D-02	-0.641D-03	0.993D+00	0.158D-02	0.505D+00	0.344D-01	0.539D+00
6.000	18.189	0.000	-20.231	-0.299D+00	-0.442D-03	-0.326D-01	-0.121D-01	0.341D+01	0.154D-02	0.242D+01	0.137D+00	0.256D+01
8.000	18.197	0.000	-20.231	-0.543D+00	-0.201D-02	-0.842D-01	-0.554D-01	0.730D+01	-0.472D-02	0.754D+01	0.391D+00	0.793D+01
10.000	18.210	0.000	-20.232	-0.841D+00	-0.497D-02	-0.167D+00	-0.138D+00	0.127D+02	-0.181D-01	0.184D+02	0.862D+00	0.192D+02
12.000	18.230	0.000	-20.233	-0.118D+01	-0.991D-02	-0.283D+00	-0.275D+00	0.194D+02	-0.448D-01	0.384D+02	0.155D+01	0.399D+02
14.000	18.257	0.000	-20.234	-0.155D+01	-0.150D-01	-0.435D+00	-0.416D+00	0.274D+02	-0.749D-01	0.717D+02	0.247D+01	0.742D+02
16.000	18.294	0.000	-20.236	-0.195D+01	-0.197D-01	-0.622D+00	-0.546D+00	0.366D+02	-0.995D-01	0.123D+03	0.365D+01	0.127D+03
18.000	18.342	0.000	-20.239	-0.239D+01	-0.243D-01	-0.844D+00	-0.671D+00	0.469D+02	-0.121D+00	0.200D+03	0.515D+01	0.205D+03
20.000	18.402	0.000	-20.242	-0.287D+01	-0.286D-01	-0.110D+01	-0.789D+00	0.584D+02	-0.134D+00	0.307D+03	0.698D+01	0.314D+03
22.000	18.476	0.000	-20.247	-0.340D+01	-0.356D-01	-0.140D+01	-0.982D+00	0.713D+02	-0.157D+00	0.451D+03	0.923D+01	0.461D+03
24.000	18.564	-0.001	-20.253	-0.401D+01	-0.350D-01	-0.183D+01	-0.164D+01	0.880D+02	0.204D+00	0.641D+03	0.118D+02	0.653D+03
26.000	18.669	-0.001	-20.260	-0.463D+01	-0.365D-01	-0.227D+01	-0.252D+01	0.105D+03	0.607D+00	0.886D+03	0.146D+02	0.901D+03
28.000	18.792	-0.001	-20.270	-0.528D+01	-0.204D-02	-0.270D+01	-0.226D+01	0.122D+03	0.141D+01	0.120D+04	0.179D+02	0.122D+04
30.000	18.933	-0.001	-20.280	-0.598D+01	0.973D-01	-0.311D+01	0.463D+00	0.139D+03	0.286D+01	0.158D+04	0.216D+02	0.160D+04
32.000	19.095	0.000	-20.292	-0.691D+01	0.132D+00	-0.341D+01	0.168D+01	0.160D+03	0.401D+01	0.204D+04	0.264D+02	0.206D+04
34.000	19.278	0.000	-20.306	-0.820D+01	0.583D-01	-0.369D+01	-0.240D+00	0.189D+03	0.455D+01	0.256D+04	0.343D+02	0.259D+04
36.000	19.481	0.000	-20.320	-0.988D+01	0.265D-01	-0.410D+01	-0.155D+01	0.226D+03	0.628D+01	0.315D+04	0.483D+02	0.320D+04
38.000	19.704	0.001	-20.336	-0.122D+02	0.801D-01	-0.454D+01	-0.166D+01	0.277D+03	0.101D+02	0.379D+04	0.721D+02	0.386D+04
40.000	19.948	0.001	-20.354	-0.149D+02	0.324D+00	-0.494D+01	0.272D+01	0.333D+03	0.171D+02	0.449D+04	0.104D+03	0.460D+04
42.000	20.212	0.003	-20.373	-0.180D+02	0.767D+00	-0.541D+01	0.108D+02	0.400D+03	0.278D+02	0.520D+04	0.136D+03	0.533D+04
44.000	20.492	0.007	-20.393	-0.220D+02	0.103D+01	-0.537D+01	0.138D+02	0.483D+03	0.377D+02	0.576D+04	0.166D+03	0.593D+04
46.000	20.782	0.010	-20.412	-0.272D+02	0.825D+00	-0.462D+01	0.280D+01	0.583D+03	0.427D+02	0.611D+04	0.192D+03	0.631D+04
48.000	21.078	0.014	-20.426	-0.336D+02	0.103D+01	-0.313D+01	-0.118D+01	0.699D+03	0.510D+02	0.623D+04	0.206D+03	0.644D+04
50.000	21.369	0.015	-20.431	-0.431D+02	-0.477D+00	0.120D+01	-0.558D+02	0.860D+03	0.409D+02	0.588D+04	0.251D+03	0.614D+04
52.000	21.644	0.010	-20.416	-0.545D+02	-0.246D+01	0.687D+01	-0.122D+03	0.104D+04	0.198D+02	0.539D+04	0.363D+03	0.575D+04
54.000	21.894	-0.005	-20.377	-0.685D+02	-0.545D+01	0.145D+02	-0.211D+03	0.126D+04	-0.927D+01	0.491D+04	0.673D+03	0.558D+04
56.000	22.111	-0.030	-20.309	-0.834D+02	-0.852D+01	0.220D+02	-0.295D+03	0.151D+04	-0.346D+02	0.471D+04	0.104D+04	0.574D+04
58.000	22.290	-0.069	-20.216	-0.991D+02	-0.135D+02	0.279D+02	-0.411D+03	0.179D+04	-0.797D+02	0.476D+04	0.128D+04	0.604D+04
60.000	22.406	-0.126	-20.096	-0.125D+03	-0.182D+02	0.375D+02	-0.524D+03	0.227D+04	-0.120D+03	0.581D+04	0.201D+04	0.782D+04
62.000	22.463	-0.202	-19.952	-0.140D+03	-0.221D+02	0.392D+02	-0.608D+03	0.259D+04	-0.146D+03	0.655D+04	0.226D+04	0.881D+04
64.000	22.487	-0.287	-19.810	-0.150D+03	-0.237D+02	0.370D+02	-0.647D+03	0.284D+04	-0.148D+03	0.673D+04	0.223D+04	0.896D+04
66.000	22.490	-0.376	-19.683	-0.158D+03	-0.241D+02	0.311D+02	-0.659D+03	0.306D+04	-0.145D+03	0.640D+04	0.206D+04	0.846D+04
68.000	22.476	-0.465	-19.584	-0.166D+03	-0.239D+02	0.220D+02	-0.658D+03	0.329D+04	-0.144D+03	0.579D+04	0.189D+04	0.768D+04
70.000	22.446	-0.552	-19.523	-0.171D+03	-0.235D+02	0.114D+02	-0.651D+03	0.348D+04	-0.141D+03	0.524D+04	0.177D+04	0.700D+04
72.000	22.406	-0.640	-19.495	-0.175D+03	-0.237D+02	0.416D+01	-0.648D+03	0.360D+04	-0.142D+03	0.484D+04	0.164D+04	0.648D+04
74.000	22.358	-0.728	-19.490	-0.180D+03	-0.238D+02	-0.130D+01	-0.646D+03	0.369D+04	-0.147D+03	0.453D+04	0.150D+04	0.604D+04
76.000	22.298	-0.816	-19.505	-0.183D+03	-0.240D+02	-0.635D+01	-0.648D+03	0.377D+04	-0.156D+03	0.443D+04	0.143D+04	0.587D+04
78.000	22.233	-0.905	-19.537	-0.185D+03	-0.242D+02	-0.114D+02	-0.655D+03	0.383D+04	-0.166D+03	0.456D+04	0.146D+04	0.602D+04
80.000	22.165	-0.995	-19.588	-0.186D+03	-0.244D+02	-0.161D+02	-0.659D+03	0.386D+04	-0.170D+03	0.477D+04	0.155D+04	0.632D+04

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 1 (SEAT. 6 DEGREE OFF H) VS. SEGMENT 1 (LT)							PANEL 1 (SEAT. 6 DEGREE OFF H) VS. SEGMENT 6 (RUL)						
TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.458	137.10	0.00	137.10	14.372	0.000	-10.459	0.250	29.94	0.00	29.94	24.725	3.420	-11.545
2.000	0.458	137.02	8.94	137.31	14.373	0.000	-10.459	0.250	31.22	4.99	31.62	24.725	3.420	-11.545
4.000	0.458	136.86	27.51	139.60	14.375	0.000	-10.459	0.250	36.69	15.37	39.79	24.726	3.420	-11.545
6.000	0.458	136.72	46.60	144.44	14.380	0.000	-10.460	0.250	44.22	22.11	49.44	24.727	3.420	-11.545
8.000	0.457	138.78	64.83	153.18	14.390	0.000	-10.461	0.251	51.70	25.85	57.80	24.729	3.420	-11.546
10.000	0.458	144.58	72.29	161.65	14.407	0.000	-10.462	0.251	58.35	29.18	65.24	24.732	3.420	-11.546
12.000	0.458	152.48	76.24	170.48	14.431	0.000	-10.465	0.252	63.83	31.91	71.36	24.737	3.420	-11.546
14.000	0.458	161.71	80.85	180.80	14.464	0.000	-10.468	0.253	68.37	34.18	76.44	24.744	3.420	-11.547
16.000	0.459	172.39	86.19	192.73	14.508	0.000	-10.473	0.254	72.13	36.06	80.64	24.755	3.420	-11.548
18.000	0.459	184.02	92.01	205.74	14.565	-0.001	-10.479	0.255	75.12	37.56	83.99	24.770	3.420	-11.550
20.000	0.460	196.74	98.37	219.96	14.635	-0.001	-10.486	0.256	76.24	38.12	85.24	24.790	3.420	-11.552
22.000	0.461	211.45	105.72	236.41	14.720	-0.001	-10.495	0.257	74.47	37.23	83.26	24.816	3.420	-11.555
24.000	0.463	200.50	100.25	224.17	14.822	-0.001	-10.506	0.257	66.45	33.22	74.29	24.849	3.420	-11.558
26.000	0.464	199.45	99.72	222.99	14.942	-0.001	-10.519	0.257	58.64	29.32	65.56	24.891	3.420	-11.563
28.000	0.465	207.89	103.94	232.42	15.081	0.000	-10.533	0.256	49.90	24.95	55.79	24.942	3.420	-11.568
30.000	0.466	228.27	114.13	255.21	15.242	0.001	-10.550	0.255	45.48	22.74	50.85	25.002	3.420	-11.574
32.000	0.468	279.53	139.76	312.52	15.424	0.006	-10.569	0.253	53.74	26.87	60.08	25.069	3.421	-11.581
34.000	0.472	356.68	178.34	398.78	15.630	0.016	-10.591	0.251	53.97	26.99	60.35	25.138	3.421	-11.589
36.000	0.478	448.62	224.31	501.57	15.859	0.038	-10.615	0.248	38.40	19.20	42.93	25.207	3.421	-11.596
38.000	0.485	560.72	280.36	626.90	16.111	0.079	-10.641	0.244	37.83	18.91	42.29	25.272	3.422	-11.603
40.000	0.496	634.27	317.14	709.14	16.385	0.146	-10.670	0.239	65.17	32.59	72.87	25.324	3.424	-11.608
42.000	0.510	664.96	332.48	743.44	16.679	0.237	-10.701	0.234	89.40	44.70	99.96	25.364	3.428	-11.612
44.000	0.527	703.41	351.70	786.43	16.985	0.346	-10.733	0.230	119.38	59.69	133.47	25.391	3.434	-11.615
46.000	0.551	756.42	378.21	845.71	17.293	0.460	-10.765	0.227	157.62	78.81	176.23	25.402	3.441	-11.616
48.000	0.585	828.62	414.31	926.43	17.592	0.567	-10.797	0.225	201.14	100.57	224.88	25.394	3.451	-11.615
50.000	0.634	922.91	461.45	1031.84	17.867	0.638	-10.826	0.225	230.71	115.35	257.94	25.366	3.464	-11.613
52.000	0.705	1043.08	521.54	1166.20	18.102	0.630	-10.850	0.225	229.76	114.88	256.88	25.326	3.480	-11.608
54.000	0.806	1090.42	545.21	1219.13	18.285	0.526	-10.869	0.227	275.31	137.65	307.80	25.267	3.497	-11.602
56.000	0.942	1085.51	542.75	1213.64	18.410	0.360	-10.883	0.237	287.36	143.68	321.28	25.149	3.514	-11.590
58.000	1.113	1255.01	627.50	1403.14	18.483	0.194	-10.890	0.263	319.10	159.55	356.77	24.927	3.526	-11.567
60.000	1.323	1450.74	725.37	1621.98	18.497	0.037	-10.892	0.312	369.55	184.78	413.17	24.589	3.526	-11.531
62.000	1.576	1827.33	913.67	2043.02	18.468	-0.132	-10.889	0.373	440.16	220.08	492.11	24.222	3.511	-11.493
64.000	1.825	2293.38	1146.69	2564.07	18.450	-0.237	-10.887	0.443	571.58	285.79	639.04	23.850	3.487	-11.453
66.000	2.046	2723.02	1361.51	3044.43	18.439	-0.287	-10.886	0.512	745.66	372.83	833.68	23.509	3.460	-11.418
68.000	2.217	3434.09	1717.05	3839.43	18.418	-0.298	-10.883	0.565	895.39	447.69	1001.07	23.230	3.435	-11.388
70.000	2.318	3801.87	1900.93	4250.62	18.370	-0.288	-10.878	0.584	304.97	152.49	340.97	23.046	3.419	-11.369
72.000	2.356	2969.04	1484.52	3319.48	18.300	-0.277	-10.871	0.565	279.61	139.80	312.61	22.958	3.408	-11.360
74.000	2.342	2947.61	1473.80	3295.52	18.218	-0.271	-10.862	0.515	213.84	106.92	239.08	22.945	3.400	-11.359
76.000	2.282	2851.26	210.71	2859.04	18.125	-0.274	-10.853	0.436	108.38	54.19	121.18	23.013	3.395	-11.366
78.000	2.180	2688.19	119.57	2690.85	18.036	-0.292	-10.843	0.328	45.56	22.78	50.93	23.161	3.390	-11.381
80.000	2.039	2461.74	235.32	2472.96	17.954	-0.332	-10.835	0.191	18.66	9.33	20.86	23.244	3.381	-11.390

DATE: 2 SEPT 1988

RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK

CRASH VICTIM: 95TH PERCENTILE MALE

CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 1 (SEAT. 6 DEGREE OFF H) VS. SEGMENT 9 (LUL)							PANEL 2 (BACK PANEL. 13 DEGR) VS. SEGMENT 1 (LT)						
TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.250	29.94	0.00	29.94	24.725	-3.420	-11.545	0.055	2.77	0.00	2.77	9.382	0.000	-12.674
2.000	0.250	31.23	5.00	31.62	24.725	-3.420	-11.545	0.055	2.76	0.40	2.79	9.382	0.000	-12.674
4.000	0.250	36.71	15.41	39.81	24.726	-3.420	-11.545	0.054	2.68	0.97	2.85	9.382	0.000	-12.675
6.000	0.250	44.24	22.12	49.46	24.727	-3.420	-11.545	0.050	2.51	1.25	2.80	9.382	0.000	-12.676
8.000	0.251	51.74	25.87	57.84	24.729	-3.420	-11.546	0.044	2.18	1.09	2.44	9.382	0.000	-12.677
10.000	0.251	58.41	29.21	65.30	24.732	-3.420	-11.546	0.033	1.65	0.83	1.85	9.381	0.000	-12.680
12.000	0.252	63.91	31.95	71.45	24.737	-3.420	-11.546	0.017	0.86	0.43	0.96	9.380	0.000	-12.684
14.000	0.253	68.45	34.23	76.53	24.744	-3.420	-11.547	-0.006	0.00	0.00	0.00	0.000	0.000	0.000
16.000	0.254	72.21	36.10	80.73	24.755	-3.420	-11.548	-0.036	0.00	0.00	0.00	0.000	0.000	0.000
18.000	0.255	75.19	37.60	84.07	24.770	-3.420	-11.550	-0.077	0.00	0.00	0.00	0.000	0.000	0.000
20.000	0.256	76.31	38.16	85.32	24.790	-3.420	-11.552	-0.128	0.00	0.00	0.00	0.000	0.000	0.000
22.000	0.257	74.63	37.31	83.43	24.815	-3.420	-11.555	-0.192	0.00	0.00	0.00	0.000	0.000	0.000
24.000	0.257	65.18	32.59	72.87	24.849	-3.420	-11.558	-0.269	0.00	0.00	0.00	0.000	0.000	0.000
26.000	0.257	56.40	28.20	63.06	24.891	-3.420	-11.563	-0.362	0.00	0.00	0.00	0.000	0.000	0.000
28.000	0.256	47.59	23.79	53.20	24.943	-3.420	-11.568	-0.472	0.00	0.00	0.00	0.000	0.000	0.000
30.000	0.254	34.68	17.34	38.78	25.005	-3.420	-11.575	-0.601	0.00	0.00	0.00	0.000	0.000	0.000
32.000	0.252	30.42	15.21	34.01	25.079	-3.419	-11.582	-0.749	0.00	0.00	0.00	0.000	0.000	0.000
34.000	0.248	29.66	14.83	33.16	25.168	-3.419	-11.592	-0.918	0.00	0.00	0.00	0.000	0.000	0.000
36.000	0.241	28.14	14.07	31.46	25.280	-3.419	-11.604	-1.108	0.00	0.00	0.00	0.000	0.000	0.000
38.000	0.227	25.44	12.72	28.44	25.426	-3.418	-11.619	-1.317	0.00	0.00	0.00	0.000	0.000	0.000
40.000	0.206	21.30	10.65	23.81	25.615	-3.415	-11.639	-1.546	0.00	0.00	0.00	0.000	0.000	0.000
42.000	0.179	16.89	8.45	18.89	25.850	-3.411	-11.663	-1.794	0.00	0.00	0.00	0.000	0.000	0.000
44.000	0.147	12.03	6.01	13.45	26.130	-3.405	-11.693	-2.056	0.00	0.00	0.00	0.000	0.000	0.000
46.000	0.112	6.87	3.43	7.68	26.435	-3.396	-11.725	-2.328	0.00	0.00	0.00	0.000	0.000	0.000
48.000	0.080	3.99	1.99	4.46	26.760	-3.386	-11.759	-2.601	0.00	0.00	0.00	0.000	0.000	0.000
50.000	0.056	2.78	1.39	3.11	27.008	-3.372	-11.785	-2.864	0.00	0.00	0.00	0.000	0.000	0.000
52.000	0.051	58.93	29.46	65.88	27.020	-3.355	-11.786	-3.104	0.00	0.00	0.00	0.000	0.000	0.000
54.000	0.076	84.08	42.04	94.01	26.648	-3.335	-11.747	-3.311	0.00	0.00	0.00	0.000	0.000	0.000
56.000	0.137	138.11	69.06	154.41	26.015	-3.313	-11.681	-3.479	0.00	0.00	0.00	0.000	0.000	0.000
58.000	0.228	165.60	82.80	185.14	25.312	-3.292	-11.607	-3.609	0.00	0.00	0.00	0.000	0.000	0.000
60.000	0.353	148.11	74.06	165.60	24.605	-3.280	-11.533	-3.695	0.00	0.00	0.00	0.000	0.000	0.000
62.000	0.522	357.14	178.57	399.30	23.920	-3.280	-11.461	-3.747	0.00	0.00	0.00	0.000	0.000	0.000
64.000	0.684	686.47	343.24	767.50	23.448	-3.290	-11.411	-3.784	0.00	0.00	0.00	0.000	0.000	0.000
66.000	0.819	1246.33	623.16	1393.44	23.155	-3.301	-11.380	-3.811	0.00	0.00	0.00	0.000	0.000	0.000
68.300	0.905	1699.87	849.94	1900.52	22.994	-3.313	-11.364	-3.828	0.00	0.00	0.00	0.000	0.000	0.000
70.000	0.924	758.55	379.27	848.08	22.932	-3.322	-11.357	-3.837	0.00	0.00	0.00	0.000	0.000	0.000
72.000	0.888	710.46	355.23	794.31	22.936	-3.329	-11.358	-3.838	0.00	0.00	0.00	0.000	0.000	0.000
74.000	0.814	611.98	305.99	684.21	22.992	-3.333	-11.363	-3.831	0.00	0.00	0.00	0.000	0.000	0.000
76.000	0.713	477.86	238.93	534.26	23.096	-3.334	-11.374	-3.811	0.00	0.00	0.00	0.000	0.000	0.000
78.000	0.591	314.21	157.11	351.30	23.266	-3.333	-11.392	-3.793	0.00	0.00	0.00	0.000	0.000	0.000
80.000	0.450	126.56	63.28	141.50	23.529	-3.333	-11.420	-3.782	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 2 (BACK PANEL. 13 DEGR) VS. SEGMENT 2 (CT)							PANEL 2 (BACK PANEL. 13 DEGR) VS. SEGMENT 3 (UT)						
TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	-0.312	0.00	0.00	0.00	0.000	0.000	0.000	0.133	9.90	0.00	9.90	6.151	0.000	-26.665
2.000	-0.312	0.00	0.00	0.00	0.000	0.000	0.000	0.132	9.87	0.06	9.87	6.151	0.000	-26.665
4.000	-0.314	0.00	0.00	0.00	0.000	0.000	0.000	0.131	9.61	0.75	9.64	6.151	0.000	-26.665
6.000	-0.320	0.00	0.00	0.00	0.000	0.000	0.000	0.126	8.90	1.74	9.07	6.151	0.000	-26.664
8.000	-0.330	0.00	0.00	0.00	0.000	0.000	0.000	0.117	7.52	2.55	7.94	6.152	0.000	-26.663
10.000	-0.347	0.00	0.00	0.00	0.000	0.000	0.000	0.102	5.25	2.42	5.77	6.152	0.000	-26.661
12.000	-0.372	0.00	0.00	0.00	0.000	0.000	0.000	0.079	3.95	1.98	4.42	6.153	0.000	-26.658
14.000	-0.406	0.00	0.00	0.00	0.000	0.000	0.000	0.048	2.38	1.19	2.66	6.154	0.000	-26.654
16.000	-0.452	0.00	0.00	0.00	0.000	0.000	0.000	0.006	0.30	0.15	0.33	6.155	0.000	-26.649
18.000	-0.510	0.00	0.00	0.00	0.000	0.000	0.000	-0.048	0.00	0.00	0.00	0.000	0.000	0.000
20.000	-0.583	0.00	0.00	0.00	0.000	0.000	0.000	-0.114	0.00	0.00	0.00	0.000	0.000	0.000
22.000	-0.671	0.00	0.00	0.00	0.000	0.000	0.000	-0.196	0.00	0.00	0.00	0.000	0.000	0.000
24.000	-0.776	0.00	0.00	0.00	0.000	0.000	0.000	-0.294	0.00	0.00	0.00	0.000	0.000	0.000
26.000	-0.901	0.00	0.00	0.00	0.000	0.000	0.000	-0.409	0.00	0.00	0.00	0.000	0.000	0.000
28.000	-1.045	0.00	0.00	0.00	0.000	0.000	0.000	-0.542	0.00	0.00	0.00	0.000	0.000	0.000
30.000	-1.211	0.00	0.00	0.00	0.000	0.000	0.000	-0.696	0.00	0.00	0.00	0.000	0.000	0.000
32.000	-1.400	0.00	0.00	0.00	0.000	0.000	0.000	-0.872	0.00	0.00	0.00	0.000	0.000	0.000
34.000	-1.612	0.00	0.00	0.00	0.000	0.000	0.000	-1.067	0.00	0.00	0.00	0.000	0.000	0.000
36.000	-1.849	0.00	0.00	0.00	0.000	0.000	0.000	-1.284	0.00	0.00	0.00	0.000	0.000	0.000
38.000	-2.110	0.00	0.00	0.00	0.000	0.000	0.000	-1.523	0.00	0.00	0.00	0.000	0.000	0.000
40.000	-2.397	0.00	0.00	0.00	0.000	0.000	0.000	-1.783	0.00	0.00	0.00	0.000	0.000	0.000
42.000	-2.707	0.00	0.00	0.00	0.000	0.000	0.000	-2.064	0.00	0.00	0.00	0.000	0.000	0.000
44.000	-3.034	0.00	0.00	0.00	0.000	0.000	0.000	-2.361	0.00	0.00	0.00	0.000	0.000	0.000
46.000	-3.370	0.00	0.00	0.00	0.000	0.000	0.000	-2.662	0.00	0.00	0.00	0.000	0.000	0.000
48.000	-3.702	0.00	0.00	0.00	0.000	0.000	0.000	-2.960	0.00	0.00	0.00	0.000	0.000	0.000
50.000	-4.012	0.00	0.00	0.00	0.000	0.000	0.000	-3.238	0.00	0.00	0.00	0.000	0.000	0.000
52.000	-4.276	0.00	0.00	0.00	0.000	0.000	0.000	-3.473	0.00	0.00	0.00	0.000	0.000	0.000
54.000	-4.477	0.00	0.00	0.00	0.000	0.000	0.000	-3.652	0.00	0.00	0.00	0.000	0.000	0.000
56.000	-4.606	0.00	0.00	0.00	0.000	0.000	0.000	-3.757	0.00	0.00	0.00	0.000	0.000	0.000
58.000	-4.661	0.00	0.00	0.00	0.000	0.000	0.000	-3.787	0.00	0.00	0.00	0.000	0.000	0.000
60.000	-4.582	0.00	0.00	0.00	0.000	0.000	0.000	-3.689	0.00	0.00	0.00	0.000	0.000	0.000
62.000	-4.378	0.00	0.00	0.00	0.000	0.000	0.000	-3.478	0.00	0.00	0.00	0.000	0.000	0.000
64.000	-4.149	0.00	0.00	0.00	0.000	0.000	0.000	-3.225	0.00	0.00	0.00	0.000	0.000	0.000
66.000	-3.915	0.00	0.00	0.00	0.000	0.000	0.000	-2.965	0.00	0.00	0.00	0.000	0.000	0.000
68.000	-3.689	0.00	0.00	0.00	0.000	0.000	0.000	-2.720	0.00	0.00	0.00	0.000	0.000	0.000
70.000	-3.476	0.00	0.00	0.00	0.000	0.000	0.000	-2.499	0.00	0.00	0.00	0.000	0.000	0.000
72.000	-3.281	0.00	0.00	0.00	0.000	0.000	0.000	-2.303	0.00	0.00	0.00	0.000	0.000	0.000
74.000	-3.098	0.00	0.00	0.00	0.000	0.000	0.000	-2.127	0.00	0.00	0.00	0.000	0.000	0.000
76.000	-2.921	0.00	0.00	0.00	0.000	0.000	0.000	-1.960	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-2.744	0.00	0.00	0.00	0.000	0.000	0.000	-1.791	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-2.561	0.00	0.00	0.00	0.000	0.000	0.000	-1.618	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD PAGE: 33.01
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 3 (FLOOR.) VS. SEGMENT 8 (RF)							PANEL 3 (FLOOR.) VS. SEGMENT 11 (LF)						
TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.096	4.82	0.00	4.82	46.596	3.420	-1.300	0.096	4.82	0.00	4.82	46.596	-3.420	-1.300
2.000	0.097	4.88	0.97	4.98	46.596	3.420	-1.300	0.097	4.88	0.97	4.98	46.596	-3.420	-1.300
4.000	0.097	4.97	2.11	5.40	46.597	3.420	-1.300	0.097	4.98	2.11	5.40	46.597	-3.420	-1.300
6.000	0.097	5.05	2.52	5.64	46.601	3.420	-1.300	0.097	5.05	2.52	5.64	46.601	-3.420	-1.300
8.000	0.098	5.02	2.51	5.62	46.609	3.420	-1.300	0.098	5.03	2.52	5.62	46.609	-3.420	-1.300
10.000	0.098	4.90	2.45	5.48	46.620	3.420	-1.300	0.098	4.91	2.46	5.49	46.620	-3.420	-1.300
12.000	0.098	4.88	2.44	5.46	46.638	3.420	-1.300	0.098	4.89	2.44	5.46	46.638	-3.420	-1.300
14.000	0.097	4.83	2.42	5.41	46.662	3.420	-1.300	0.097	4.84	2.42	5.41	46.662	-3.420	-1.300
16.000	0.095	4.75	2.37	5.31	46.693	3.420	-1.300	0.095	4.76	2.38	5.32	46.694	-3.420	-1.300
18.000	0.092	4.61	2.31	5.16	46.734	3.420	-1.300	0.093	4.63	2.31	5.17	46.734	-3.420	-1.300
20.000	0.088	4.42	2.21	4.94	46.784	3.420	-1.300	0.089	4.44	2.22	4.97	46.784	-3.420	-1.300
22.000	0.083	4.17	2.08	4.66	46.844	3.420	-1.300	0.084	4.19	2.10	4.69	46.845	-3.420	-1.300
24.000	0.077	3.85	1.92	4.30	46.915	3.420	-1.300	0.078	3.88	1.94	4.34	46.916	-3.420	-1.300
26.000	0.069	3.46	1.73	3.86	46.998	3.420	-1.300	0.070	3.50	1.75	3.91	46.999	-3.420	-1.300
28.000	0.060	2.99	1.50	3.35	47.092	3.420	-1.300	0.061	3.05	1.52	3.41	47.093	-3.420	-1.300
30.000	0.049	2.46	1.23	2.75	47.199	3.420	-1.300	0.051	2.54	1.27	2.83	47.201	-3.420	-1.300
32.000	0.037	1.85	0.93	2.07	47.318	3.420	-1.300	0.040	1.98	0.99	2.21	47.322	-3.420	-1.300
34.000	0.022	1.12	0.56	1.26	47.448	3.420	-1.300	0.027	1.36	0.68	1.52	47.456	-3.420	-1.300
36.000	0.004	0.19	0.10	0.21	47.583	3.420	-1.300	0.013	0.65	0.32	0.73	47.597	-3.420	-1.300
38.000	-0.021	0.00	0.00	0.00	0.000	0.000	0.000	-0.004	0.00	0.00	0.00	0.000	0.000	0.000
40.000	-0.052	0.00	0.00	0.00	0.000	0.000	0.000	-0.024	0.00	0.00	0.00	0.000	0.000	0.000
42.000	-0.092	0.00	0.00	0.00	0.000	0.000	0.000	-0.047	0.00	0.00	0.00	0.000	0.000	0.000
44.000	-0.140	0.00	0.00	0.00	0.000	0.000	0.000	-0.072	0.00	0.00	0.00	0.000	0.000	0.000
46.000	-0.199	0.00	0.00	0.00	0.000	0.000	0.000	-0.101	0.00	0.00	0.00	0.000	0.000	0.000
48.000	-0.268	0.00	0.00	0.00	0.000	0.000	0.000	-0.137	0.00	0.00	0.00	0.000	0.000	0.000
50.000	-0.348	0.00	0.00	0.00	0.000	0.000	0.000	-0.183	0.00	0.00	0.00	0.000	0.000	0.000
52.000	-0.440	0.00	0.00	0.00	0.000	0.000	0.000	-0.245	0.00	0.00	0.00	0.000	0.000	0.000
54.000	-0.543	0.00	0.00	0.00	0.000	0.000	0.000	-0.330	0.00	0.00	0.00	0.000	0.000	0.000
56.000	-0.661	0.00	0.00	0.00	0.000	0.000	0.000	-0.434	0.00	0.00	0.00	0.000	0.000	0.000
58.000	-0.798	0.00	0.00	0.00	0.000	0.000	0.000	-0.554	0.00	0.00	0.00	0.000	0.000	0.000
60.000	-0.960	0.00	0.00	0.00	0.000	0.000	0.000	-0.686	0.00	0.00	0.00	0.000	0.000	0.000
62.000	-1.145	0.00	0.00	0.00	0.000	0.000	0.000	-0.830	0.00	0.00	0.00	0.000	0.000	0.000
64.000	-1.351	0.00	0.00	0.00	0.000	0.000	0.000	-0.974	0.00	0.00	0.00	0.000	0.000	0.000
66.000	-1.576	0.00	0.00	0.00	0.000	0.000	0.000	-1.122	0.00	0.00	0.00	0.000	0.000	0.000
68.000	-1.817	0.00	0.00	0.00	0.000	0.000	0.000	-1.277	0.00	0.00	0.00	0.000	0.000	0.000
70.000	-2.071	0.00	0.00	0.00	0.000	0.000	0.000	-1.446	0.00	0.00	0.00	0.000	0.000	0.000
72.000	-2.335	0.00	0.00	0.00	0.000	0.000	0.000	-1.625	0.00	0.00	0.00	0.000	0.000	0.000
74.000	-2.606	0.00	0.00	0.00	0.000	0.000	0.000	-1.812	0.00	0.00	0.00	0.000	0.000	0.000
76.000	-2.883	0.00	0.00	0.00	0.000	0.000	0.000	-2.005	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-3.160	0.00	0.00	0.00	0.000	0.000	0.000	-2.199	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-3.434	0.00	0.00	0.00	0.000	0.000	0.000	-2.387	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

	PANEL 4 (HEAD PAD. 13 DEGR) VS. SEGMENT 5 (H)							PANEL 10 (RUDDER PEDALS.) VS. SEGMENT 8 (RF)						
TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.050	2.48	0.00	2.48	3.935	0.000	-40.978	0.002	0.08	0.00	0.08	51.239	3.420	-3.286
2.000	0.049	2.47	0.02	2.47	3.935	0.000	-40.978	0.001	0.07	0.01	0.07	51.239	3.420	-3.286
4.000	0.048	2.38	0.19	2.39	3.935	0.000	-40.978	0.002	0.11	0.04	0.12	51.239	3.420	-3.285
6.000	0.043	2.15	0.41	2.19	3.935	0.000	-40.977	0.005	0.29	0.14	0.32	51:240	3.420	-3.287
8.000	0.034	1.70	0.55	1.78	3.935	0.000	-40.976	0.010	0.75	0.37	0.83	51.245	3.420	-3.291
10.000	0.019	0.95	0.41	1.03	3.936	0.000	-40.974	0.019	1.59	0.80	1.78	51.254	3.420	-3.298
12.000	-0.003	0.00	0.00	0.00	0.000	0.000	0.000	0.031	2.66	1.33	2.98	51.266	3.420	-3.309
14.000	-0.034	0.00	0.00	0.00	0.000	0.000	0.000	0.048	4.09	2.05	4.58	51.284	3.420	-3.323
16.000	-0.075	0.00	0.00	0.00	0.000	0.000	0.000	0.070	5.92	2.96	6.62	51.306	3.420	-3.342
18.000	-0.128	0.00	0.00	0.00	0.000	0.000	0.000	0.096	8.17	4.08	9.13	51.334	3.420	-3.365
20.000	-0.194	0.00	0.00	0.00	0.000	0.000	0.000	0.128	13.66	6.83	15.28	51.367	3.420	-3.393
22.000	-0.274	0.00	0.00	0.00	0.000	0.000	0.000	0.165	20.41	10.21	22.82	51.406	3.420	-3.426
24.000	-0.371	0.00	0.00	0.00	0.000	0.000	0.000	0.205	28.17	14.09	31.50	51.464	3.420	-3.474
26.000	-0.484	0.00	0.00	0.00	0.000	0.000	0.000	0.249	38.47	19.24	43.01	51.490	3.420	-3.496
28.000	-0.617	0.00	0.00	0.00	0.000	0.000	0.000	0.296	49.29	24.64	55.10	51.503	3.420	-3.507
30.000	-0.770	0.00	0.00	0.00	0.000	0.000	0.000	0.343	60.44	30.22	67.58	51.511	3.420	-3.514
32.000	-0.945	0.00	0.00	0.00	0.000	0.000	0.000	0.392	71.83	35.92	80.31	51.516	3.420	-3.518
34.000	-1.142	0.00	0.00	0.00	0.000	0.000	0.000	0.440	128.19	64.09	143.32	51.520	3.420	-3.521
36.000	-1.363	0.00	0.00	0.00	0.000	0.000	0.000	0.477	178.75	89.37	199.85	51.521	3.420	-3.522
38.000	-1.610	0.00	0.00	0.00	0.000	0.000	0.000	0.496	204.92	102.46	229.11	51.519	3.420	-3.521
40.000	-1.882	0.00	0.00	0.00	0.000	0.000	0.000	0.498	191.03	95.51	213.58	51.515	3.420	-3.517
42.000	-2.181	0.00	0.00	0.00	0.000	0.000	0.000	0.492	182.60	91.30	204.15	51.508	3.419	-3.511
44.000	-2.505	0.00	0.00	0.00	0.000	0.000	0.000	0.482	168.82	84.41	188.75	51.501	3.418	-3.505
46.000	-2.849	0.00	0.00	0.00	0.000	0.000	0.000	0.470	153.91	76.96	172.08	51.494	3.417	-3.499
48.000	-3.211	0.00	0.00	0.00	0.000	0.000	0.000	0.460	139.82	69.91	156.32	51.489	3.415	-3.495
50.000	-3.584	0.00	0.00	0.00	0.000	0.000	0.000	0.450	126.65	63.33	141.60	51.488	3.413	-3.495
52.000	-3.960	0.00	0.00	0.00	0.000	0.000	0.000	0.441	114.28	57.14	127.77	51.494	3.410	-3.499
54.000	-4.328	0.00	0.00	0.00	0.000	0.000	0.000	0.430	100.59	50.30	112.47	51.507	3.406	-3.510
56.000	-4.675	0.00	0.00	0.00	0.000	0.000	0.000	0.415	79.36	39.68	88.73	51.531	3.402	-3.531
58.000	-4.989	0.00	0.00	0.00	0.000	0.000	0.000	0.388	57.60	28.80	64.40	51.577	3.398	-3.569
60.000	-5.254	0.00	0.00	0.00	0.000	0.000	0.000	0.346	49.17	24.59	54.98	51.679	3.394	-3.654
62.000	-5.458	0.00	0.00	0.00	0.000	0.000	0.000	0.289	37.73	18.86	42.18	51.812	3.392	-3.767
64.000	-5.609	0.00	0.00	0.00	0.000	0.000	0.000	0.215	23.04	11.52	25.75	51.976	3.393	-3.904
66.000	-5.724	0.00	0.00	0.00	0.000	0.000	0.000	0.125	8.82	4.41	9.86	52.183	3.400	-4.077
68.000	-5.817	0.00	0.00	0.00	0.000	0.000	0.000	0.020	0.99	0.49	1.10	52.440	3.417	-4.294
70.000	-5.894	0.00	0.00	0.00	0.000	0.000	0.000	-0.101	0.00	0.00	0.00	0.000	0.000	0.000
72.000	-5.963	0.00	0.00	0.00	0.000	0.000	0.000	-0.231	0.00	0.00	0.00	0.000	0.000	0.000
74.000	-6.032	0.00	0.00	0.00	0.000	0.000	0.000	-0.367	0.00	0.00	0.00	0.000	0.000	0.000
76.000	-6.105	0.00	0.00	0.00	0.000	0.000	0.000	-0.510	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-6.178	0.00	0.00	0.00	0.000	0.000	0.000	-0.655	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-6.252	0.00	0.00	0.00	0.000	0.000	0.000	-0.800	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE
CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS

PANEL 10 (RUDDER PEDALS.) VS. SEGMENT 11 (LF)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) (VEH REFERENCE) X	Y	Z
0.000	0.002	0.08	0.00	0.08	51.239	-3.420	-3.286
2.000	0.001	0.07	0.01	0.07	51.239	-3.420	-3.286
4.000	0.002	0.11	0.04	0.12	51.239	-3.420	-3.285
6.000	0.005	0.29	0.14	0.32	51.240	-3.420	-3.287
8.000	0.010	0.75	0.37	0.83	51.245	-3.420	-3.291
10.000	0.019	1.60	0.80	1.78	51.254	-3.420	-3.298
12.000	0.031	2.67	1.33	2.98	51.266	-3.420	-3.308
14.000	0.048	4.10	2.05	4.58	51.284	-3.420	-3.323
16.000	0.070	5.93	2.96	6.63	51.306	-3.420	-3.342
18.000	0.096	8.18	4.09	9.15	51.334	-3.420	-3.365
20.000	0.128	13.70	6.85	15.32	51.366	-3.420	-3.393
22.000	0.165	20.47	10.23	22.88	51.406	-3.420	-3.425
24.000	0.206	28.26	14.13	31.59	51.464	-3.420	-3.474
26.000	0.250	38.58	19.29	43.14	51.489	-3.420	-3.496
28.000	0.296	49.45	24.73	55.29	51.503	-3.420	-3.507
30.000	0.344	60.69	30.34	67.85	51.511	-3.420	-3.513
32.000	0.394	72.29	36.14	80.82	51.516	-3.420	-3.518
34.000	0.444	133.60	66.80	149.37	51.519	-3.420	-3.520
36.000	0.483	188.09	94.05	210.29	51.519	-3.420	-3.520
38.000	0.507	219.74	109.87	245.68	51.515	-3.420	-3.518
40.000	0.514	216.05	108.03	241.55	51.508	-3.420	-3.511
42.000	0.515	213.02	106.51	238.16	51.497	-3.421	-3.502
44.000	0.514	212.01	106.00	237.03	51.482	-3.422	-3.490
46.000	0.514	211.89	105.95	236.90	51.465	-3.423	-3.475
48.000	0.514	212.07	106.04	237.10	51.446	-3.425	-3.459
50.000	0.511	207.70	103.85	232.22	51.425	-3.427	-3.441
52.000	0.498	190.37	95.18	212.83	51.399	-3.430	-3.420
54.000	0.472	155.61	77.80	173.97	51.361	-3.432	-3.388
56.000	0.436	107.92	53.96	120.66	51.306	-3.435	-3.342
58.000	0.395	59.01	29.50	65.97	51.268	-3.437	-3.310
60.000	0.353	50.53	25.27	56.50	51.259	-3.438	-3.302
62.000	0.307	41.43	20.72	46.32	51.288	-3.438	-3.327
64.000	0.268	33.64	16.82	37.61	51.387	-3.436	-3.409
66.000	0.234	26.90	13.45	30.07	51.514	-3.432	-3.516
68.000	0.200	20.05	10.02	22.41	51.657	-3.425	-3.637
70.000	0.159	13.90	6.95	15.54	51.813	-3.413	-3.767
72.000	0.112	6.75	3.37	7.55	51.972	-3.393	-3.901
74.000	0.056	2.80	1.40	3.13	52.128	-3.366	-4.032
76.000	-0.008	0.00	0.00	0.00	0.000	0.000	0.000
78.000	-0.077	0.00	0.00	0.00	0.000	0.000	0.000
80.000	-0.141	0.00	0.00	0.00	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

HARNESS SYSTEM BELT ENDPOINT FORCES

	BELT NO. 1 OF HARNESS NO. 1				BELT NO. 2 OF HARNESS NO. 1			
	POINT NO. 1		POINT NO. 12		POINT NO. 13		POINT NO. 27	
TIME (MSEC)	STRAIN (IN./ IN.)	FORCE (LB.)	STRAIN (IN./ IN.)	FORCE (LB.)	STRAIN (IN./ IN.)	FORCE (LB.)	STRAIN (IN./ IN.)	FORCE (LB.)
0.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00
2.000	0.000025	0.37	0.000017	0.25	0.000014	0.21	0.000018	0.27
4.000	0.000119	1.79	0.000065	0.98	0.000057	0.85	0.000152	2.27
6.000	0.000281	4.22	0.000150	2.25	0.000124	1.86	0.000470	7.04
8.000	0.000523	7.85	0.000276	4.15	0.000219	3.29	0.001018	15.27
10.000	0.000854	12.81	0.000438	6.57	0.000336	5.04	0.001803	27.04
12.000	0.001023	15.34	0.000481	7.21	0.000344	5.16	0.002454	36.81
14.000	0.001320	19.80	0.000515	7.72	0.000433	6.50	0.003168	47.52
16.000	0.001672	25.08	0.000551	8.27	0.000496	7.44	0.003856	57.84
18.000	0.001420	21.30	0.000400	6.00	0.000404	6.06	0.003427	51.41
20.000	0.001831	27.46	0.000484	7.26	0.000498	7.46	0.004276	64.13
22.000	0.002363	35.45	0.000617	9.26	0.000643	9.65	0.005479	82.19
24.000	0.003085	46.27	0.000877	13.15	0.000921	13.81	0.019008	285.12
26.000	0.004040	60.61	0.001215	18.22	0.001284	19.26	0.021036	315.53
28.000	0.006003	90.05	0.001724	25.85	0.001768	26.52	0.027340	410.10
30.000	0.009472	142.08	0.002256	33.83	0.002429	36.44	0.035707	564.14
32.000	0.013979	209.69	0.003249	48.73	0.004372	65.58	0.023671	355.06
34.000	0.019790	296.85	0.004754	71.30	0.008401	126.02	0.020865	312.97
36.000	0.026146	392.20	0.007124	106.86	0.018334	275.01	0.025025	375.38
38.000	0.032200	494.00	0.010831	162.46	0.030199	453.97	0.039302	636.04
40.000	0.037809	606.17	0.021023	315.35	0.040241	654.82	0.056200	1170.59
42.000	0.043063	711.27	0.036025	570.49	0.050245	863.00	0.075150	2182.96
44.000	0.048343	816.85	0.053858	1054.46	0.060539	1408.57	0.064897	1639.53
46.000	0.053827	1052.84	0.071518	1990.44	0.072248	2029.17	0.084525	2679.84
48.000	0.055271	1129.35	0.087363	2830.23	0.056456	1192.15	0.103767	3631.84
50.000	0.058800	1316.42	0.098307	3410.27	0.065766	1685.60	0.093883	3175.81
52.000	0.064710	1629.61	0.098688	3430.48	0.068526	1831.86	0.107224	3752.85
54.000	0.072120	2022.35	0.087992	2863.56	0.074577	2152.58	0.092638	3109.84
56.000	0.076068	2231.59	0.071069	1966.67	0.075155	2183.20	0.089018	2917.94
58.000	0.074497	2148.32	0.049516	840.31	0.069789	1898.82	0.084438	2675.23
60.000	0.061993	1485.61	0.026359	395.38	0.082583	2576.88	0.093363	3148.22
62.000	0.047024	790.48	0.005156	77.34	0.032040	490.80	0.086107	2763.69
64.000	0.028177	422.66	0.000000	0.00	0.024499	367.48	0.065353	1663.72
66.000	0.007038	105.57	0.000000	0.00	0.006231	93.46	0.051787	944.69
68.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.037962	609.25
70.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.022501	337.51
72.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.012711	190.67
74.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.006159	92.39
76.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00
78.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00
80.000	0.000000	0.00	0.000000	0.00	0.000000	0.00	0.000000	0.00

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

CONTACT FORCES - SEGMENT NO. 2 (CT) VS. SEGMENT NO. 13 (RLA)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 2 LOCAL REFERENCE X	Y	Z	SEG. 13 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.0[illegible]	[illegible].000	0.000	0.000	0.000	0.000	0.000
44.000	0.009	4.39	1.10	4.[illegible]	[illegible].018	5.365	-1.749	-0.875	-0.809	-7.906
46.000	0.010	3.62	0.90	3.73	2.036	5.360	-1.739	-0.881	-0.803	-7.903
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
80.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

CONTACT FORCES - SEGMENT NO. 2 (CT) VS. SEGMENT NO. 15 (LLA)

	DEFL-	NORMAL	FRICTION	RESULTANT	CONTACT LOCATION (IN.)					
TIME	ECTION	FORCE	FORCE	FORCE	SEG. 2 LOCAL REFERENCE			SEG. 15 LOCAL REFERENCE		
(MSEC)	(IN.)	(LB.)	(LB.)	(LB.)	X	Y	Z	X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
80.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

CONTACT FORCES - SEGMENT NO. 6 (RUL) VS. SEGMENT NO. 13 (RLA)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 6 LOCAL REFERENCE X	Y	Z	SEG. 13 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
80.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

CONTACT FORCES - SEGMENT NO. 9 (LUL) VS. SEGMENT NO. 15 (LLA)

	DEFL-	NORMAL	FRICTION	RESULTANT	CONTACT LOCATION (IN.)					
TIME	ECTION	FORCE	FORCE	FORCE	SEG. 9 LOCAL REFERENCE			SEG. 15 LOCAL REFERENCE		
(MSEC)	(IN.)	(LB.)	(LB.)	(LB.)	X	Y	Z	X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
74.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
76.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
78.000	0.282	132.75	33.19	136.84	1.229	-1.146	10.441	-1.121	0.658	6.935
80.000	0.685	321.84	80.46	331.75	1.096	-1.142	10.037	-1.019	0.683	6.725

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD
VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

CONTACT FORCES - SEGMENT NO. 13 (RLA) VS. SEGMENT NO. 16 (VEH)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 13 LOCAL REFERENCE X	Y	Z	SEG. 16 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.217	24.79	12.39	27.71	1.714	0.433	2.758	32.371	6.599	-23.212
70.000	0.496	193.03	96.51	215.81	1.651	0.426	3.110	32.482	6.706	-23.329
72.000	0.671	444.83	222.41	497.33	1.602	0.408	3.504	32.546	6.820	-23.401
74.000	0.627	362.71	181.36	405.53	1.587	0.388	3.859	32.512	6.921	-23.391
76.000	0.420	87.00	43.50	97.27	1.600	0.370	4.164	32.409	7.003	-23.320
78.000	0.219	23.90	11.95	26.72	1.612	0.354	4.449	32.311	7.076	-23.249
80.000	0.103	5.46	2.73	6.10	1.608	0.342	4.722	32.256	7.143	-23.206

DATE: 2 SEPT 1988
RUN DESCRIPTION: EXAMPLE 1: BASIC SLED TEST SIMULATION
TWO BELT HARNESS WITH HYPERELLIPSOID FOR DASH BOARD

VEHICLE DECELERATION: SLED ACCELERATION - 20G PEAK
CRASH VICTIM: 95TH PERCENTILE MALE

CONTACT FORCES - SEGMENT NO. 15 (LLA) VS. SEGMENT NO. 16 (VEH)

TIME (MSEC)	DEFL-ECTION (IN.)	NORMAL FORCE (LB.)	FRICTION FORCE (LB.)	RESULTANT FORCE (LB.)	CONTACT LOCATION (IN.) SEG. 15 LOCAL REFERENCE X	Y	Z	SEG. 16 LOCAL REFERENCE X	Y	Z
0.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
4.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
6.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
8.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
10.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
12.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
14.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
16.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
18.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
20.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
22.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
24.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
26.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
28.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
30.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
32.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
34.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
36.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
38.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
42.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
44.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
46.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
48.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
50.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
52.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
54.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
56.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
58.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
60.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
62.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
64.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
66.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
68.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
70.000	0.000	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000
72.000	0.524	226.73	113.37	253.49	1.755	0.307	0.651	32.615	-6.119	-23.311
74.000	0.804	610.21	305.10	682.23	1.712	0.298	0.537	32.732	-6.130	-23.436
76.000	0.907	736.13	368.06	823.02	1.699	0.281	0.427	32.764	-6.147	-23.486
78.000	0.798	590.20	295.10	659.86	1.720	0.263	0.294	32.694	-6.176	-23.450
80.000	0.583	303.74	151.87	339.60	1.758	0.244	0.157	32.574	-6.224	-23.368

HEAD INJURY CRITERION

HIC = 192.44 TIME DURATION = 52.000 TO 65.000 MSEC
WITH HEAD RESULTANTS = 25.844 AND 23.464 G'S

AVERAGE HEAD RESULTANT FOR TIME DURATION = 46.574 G'S

HEAD SEVERITY INDEX

HSI = 245.20

MAX HEAD RESULTANT = 65.716 G'S AT 60.000 MSEC

CHEST SEVERITY INDEX

CSI = 733.64

MAX CHEST RESULTANT = 146.473 G'S AT 59.000 MSEC

ELAPSED CPU TIME =   291.45 SECONDS

SUB	CALLS	TIME	%
MAIN3D	1	155	0.53
INPUT	1	305	1.05
CHAIN	484	832	2.85
EJOINT	484	29	0.10
DINT	41	885	3.04
PDAUX	568	1112	3.82
DAUX	483	1056	3.62
SETUP1	483	766	2.63
CONTCT	483	444	1.52
PLELP	5313	2244	7.70
SEGSEG	2898	2029	6.96
HBELT	1072	4385	15.05
VISPR	483	1922	6.59
SETUP2	483	157	0.54
DAUX11	483	1562	5.36
DAUX12	483	678	2.33
DAUX22	483	370	1.27
FSMSOL	1072	3988	13.68
OUTPUT	86	707	2.43
UPDATE	85	53	0.18
HPTURB	85	3862	13.25
DZP	482	455	1.56
POSTPR	1	1149	3.94
TOTAL		29145	100.00

APPENDIX D1

Example 2, ATB Dynamic Joint Test
Input File (EX2.AIN)

```
  FEB. 4, 1988  0   0     0.0                                                  CARD A1A
EXAMPLE 2:  DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND
 IN. LB.SEC.          0.0          0.0     386.088         0.0             CARD A3
   4  20    0.002  0.0005    0.001 .000063                                 CARD A4
 1 020 2 0 0 0 0 0 0 0 0 0 0 0 0 0 016 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 1CARD A5
    2     1        95TH PERCENTILE MALE                                    CARD B1
LARM L 5.901 .3331 .3331 .0214 1.871 1.87110.269 0.000 0.000 0.000         CARD B2A
UARM U 5.542 .1743 .1743 .0259 2.122 2.122 7.497 0.000 0.000 0.000         CARD B2A
ELBW E    1    5  0.00  0.00  8.20  0.00  0.00 -5.42    1  0.00  0.00      CARD B3A
                0.00  0.00  0.00  0.00-67.19  0.00
   .00   .00   .00   .00         .00   .00   .00   .00   .00          .00CARD B4
   0.0   0.0   30.   0.0   0.0                     0.0   0.0             CARD B5
   .00   .00   .00   .00   .00   .00   .01   .01  .001  .001  .001  .001CARD B6
   .00   .00   .00   .00   .00   .00   .01   .01  .001   .00   .00   .00CARD B6
CONSTANT WIND VELOCITY OF 600 KNOTS
   0.0   0.0   0.012161.  0.00  0.00  0.00  0.00    -3   0.0  2.30    0CARD C2A
     2     1     3                                                     CARD C2B
     0.000     0.000     0.000     0.000     0.000     0.000     0.000 CARD C5
     0.000     0.000     0.000 12161.000     0.000     0.000     0.000 CARD C5
     2.300     0.000     0.000 12161.000     0.000     0.000     0.000 CARD C5
     4.600     0.000     0.000 12161.000     0.000     0.000     0.000 CARD C5
     1     0     0     0     0     0     0     1     0     0             CARD D1
   1     WIND PLANE                                                      CARD D2A
        10.0         10.0         5.0                                    CARD D2B
       -10.0         10.0         5.0                                    CARD D2C
        10.0        -10.0         5.0                                    CARD D2D
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0             CARD D7
 999                                                                     CARD E1
   1     WIND FORCE                                                      CARD E6A
      1.4000  13404.0000      14.6960          1           3             CARD E6B
   0                                                                     CARD F1A
   0   0                                                                 CARD F3A
   0                                                                     CARD F4A
   1   1                                                                 CARD F7A
  -1   1   3   1   1   0   1 2 2                                         CARD F7B
  -2   2   3   1   1   0   1 1 1                                         CARD F7B
       0.0        0.0        0.0   0   0   0   0   1                     CARD G1A
   0.66000   0.00000 -18.98000       0.0        0.0        0.0           CARD G2A
      0.00     -2.00      0.00      0.00      0.00      0.00  3  2  1  0CARD G3A
      0.00     -2.00      0.00      0.00      0.00      0.00  3  2  1  0CARD G3A
     0                                                                   CARD H1A
                                                                         CARD H1B
     0                                                                   CARD H2A
                                                                         CARD H2B
     3  2  1        0.0         0.0        8.20                          CARD H3A
        1  2        0.0         0.0       -5.42                          CARD H3B
        4  2        0.0         0.0         0.0                          CARD H3B
     0                                                                   CARD H4
     0                                                                   CARD H5
     0                                                                   CARD H6
     1     1                                                             CARD H7
     2  0  1  0  2                                                       CARD H8
     1  1  1                                                             CARD H9
     0                                                                   CARD H10
                                                                         CARD H11
```

APPENDIX D2

Example 2, ATB Dynamic Joint Test
386 Directory File (ATBIV2.DIR)

EXP2.TP1	UNIT 1	ATB OUTPUT, VIEW BODY ELEMENT AND CONTACT PLANE INPUT	
EXP2.PRP	UNIT 2	ATB PRINTER PLOTS	
ATB.ROU	UNIT 3	ATB RESTART RUN OUTPUT FILE	
ATB.RIN	UNIT 4	ATB RESTART RUN INPUT FILE	
EX2.AIN	UNIT 5	ATB INPUT, GEBOD BODY DESCRIPTION OUTPUT	
EXP2.AOU	UNIT 6	ATB PRIMARY OUTPUT FILE	
EXP2.TP8	UNIT 8	ATB SUBROUTINE POSTPR OUTPUT FILE	
0 IDEF	UNIT 10	DRAWING OPTION	SEE PLOTWORKS, PLOT88, 3.1
91 IOPORT	UNIT 10	HARDWARE INTERFACE 91/ 1	SEE PLOTWORKS, PLOT88, 3.1
91 MODEL	UNIT 10	OUTPUT DEVICE 91/64	SEE PLOTWORKS, PLOT88, 3.1
EXP2.T24	21 - 85	LAST ATB TABULAR TIME HISTORY OUTPUT FILE (21-85)	

APPENDIX D3

Example 2, ATB Dynamic Joint Test
386 Output File (EXP2.AOU)

DEVELOPED BY CALSPAN CORP., P.O. BOX 400, BUFFALO NY 14225
AND BY J&J TECHNOLOGIES INC., ORCHARD PARK, NY 14127

FOR THE AIR FORCE ARMSTRONG AEROSPACE MEDICAL RESEARCH
LABORATORY, WRIGHT PATTERSON AIR FORCE BASE
UNDER CONTRACTS F33615-75C-5002,-78C-0516 AND -80C-05117

AND FOR THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION,
U.S. DEPARTMENT OF TRANSPORTATION, UNDER CONTRACTS
FH-11-7592, HS-053-2-485, HS-6-01300 AND HS-6-01410.

PROGRAM DOCUMENTATION: NHTSA REPORT NOS. DOT-HS-801-507
THROUGH 510 (FORMERLY CALSPAN REPORT NO. ZQ-5180-L-1),
AVAILABLE FROM NTIS (ACCESSION NOS. PB-241692,3,4 AND 5),
APPENDIXES A-J TO THE ABOVE (AVAILABLE FROM CALSPAN),
AND REPORT NOS. AMRL-TR-75-14 (NTIS NO. AD-A014 816),
AFAMRL-TR-80-14 (NTIS NO. AD-A088 029), AND
AFAMRL-TR-83-073 (NTIS NO. AD-B079 184).

PROGRAM ATB-IV 80386 IMPLEMENTATION COMPLETED BY KETRON,
OCTOBER 31, 1989, UNDER CONTRACT F33615-88-C-0543

```
  FEB. 4, 1988  IRSIN=   0  IRSOUT=   0  RSTIME =  0.0000                                                   CARDS A

EXAMPLE 2:  DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND

    UNITL =  IN.     UNITM =  LB.     UNITT = SEC.     GRAVITY VECTOR = (    0.0000,    0.0000, 386.0880)     G = 386.0880

    NDINT =    4     NSTEPS =   20     DT =0.002000     HO =0.000500     HMAX =0.001000     HMIN =0.000063
 NPRT ARRAY
    1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
    1  0 20  2  0  0  0  0  0  0  0  0  0  0  0  0  0 16  0  0  0  0  0  0  0  1  0  0  0  1  0  0  0  0  0  1
```

CARD B.1
CARDS B.2

SEGMENT			WEIGHT	PRINCIPAL MOMENTS OF INERTIA (LB.-SEC.**2- IN.)			SEGMENT CONTACT ELLIPSOID SEMIAXES (IN.)			CENTER (IN.)			PRINCIPAL AXES (DEG)		
I	SYM	PLOT	(LB.)	X	Y	Z	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL
1	LARM	L	5.901	0.3331	0.3331	0.0214	1.871	1.871	10.269	0.000	0.000	0.000	0.00	0.00	0.00
2	UARM	U	5.542	0.1743	0.1743	0.0259	2.122	2.122	7.497	0.000	0.000	0.000	0.00	0.00	0.00

CARDS B.3

JOINT					LOCATION(IN.) - SEG(JNT)			LOCATION(IN.) - SEG(J+1)			PRIN. AXIS(DEG) - SEG(JNT)			PRIN. AXIS(DEG) - SEG(J+1)		
J	SYM	PLOT	JNT	PIN	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL	YAW	PITCH	ROLL
1	ELBW	E	1	5	0.000	0.000	8.200	0.000	0.000	-5.420	0.00	0.00	0.00	0.00	-67.19	0.00

UNLOCK CONDITIONS FOR SLIP JOINTS

JOINT	TENSION (LB.)	COMPRESSION (LB.)
1	0.000	0.000

CARDS B.4

	FLEXURAL SPRING CHARACTERISTICS					TORSIONAL SPRING CHARACTERISTICS				
	SPRING COEF. (IN. LB./DEG**J)			ENERGY	JOINT	SPRING COEF. (IN. LB./DEG**J)			ENERGY	JOINT
JOINT	LINEAR	QUADRATIC	CUBIC	DISSIPATION	STOP	LINEAR	QUADRATIC	CUBIC	DISSIPATION	STOP
	(J=1)	(J=2)	(J=3)	COEF.	(DEG)	(J=1)	(J=2)	(J=3)	COEF.	(DEG)
1 ELBW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

CARDS B.5

JOINT VISCOUS CHARACTERISTICS AND LOCK-UNLOCK CONDITIONS

JOINT	VISCOUS COEFFICIENT (IN. LB.SEC./DEG)	COULOMB FRICTION COEF. (IN. LB.)	FULL FRICTION ANGULAR VELOCITY (DEG/SEC.)	MAX TORQUE FOR A LOCKED JOINT (IN. LB.)	MIN TORQUE FOR UNLOCKED JOINT (IN. LB.)	MIN. ANG. VELOCITY FOR UNLOCKED JOINT (RAD/SEC.)	IMPULSE RESTITUTION COEFFICIENT
1 ELBW	0.000	0.00	30.00	0.00	0.00	0.00	0.000

SEGMENT INTEGRATION CONVERGENCE TEST INPUT

SEGMENT		ANGULAR VELOCITIES (RAD/SEC.)			LINEAR VELOCITIES (IN./SEC.)			ANGULAR ACCELERATIONS (RAD/SEC.**2)			LINEAR ACCELERATIONS (IN./SEC.**2)		
NO.	SYM	MAG. TEST	ABS. ERROR	REL. ERROR	MAG. TEST	ABS. ERROR	REL. ERROR	MAG. TEST	ABS. ERROR	REL. ERROR	MAG. TEST	ABS. ERROR	REL. ERROR
1	LARM	0.000	0.000	0.0000	0.000	0.000	0.0000	0.010	0.010	0.0010	0.001	0.001	0.0010
2	UARM	0.000	0.000	0.0000	0.000	0.000	0.0000	0.010	0.010	0.0010	0.000	0.000	0.0000

CONSTANT WIND VELOCITY OF 600 KNOTS

YAW	PITCH	ROLL	VIPS	VTIME	XO(X)	XO(Y)	XO(Z)	NATAB	ATO	ADT	MSEG
0.000	0.000	0.000	12161.000	0.000	0.000	0.000	0.000	-3	0.000000	2.300000	0

SPLINE FIT TABULAR INPUT

LTYPE = 2 LFIT = 1 NPTS = 3

	INITIAL LINEAR POSITION (IN.)			INITIAL ANGULAR POSITION (DEG)		
TIME(SEC.)= 0.0000	X= 0.000	Y= 0.000	Z= 0.000	X= 0.000	Y= 0.000	Z= 0.000

	LINEAR VELOCITY (IN./SEC.)			ANGULAR VELOCITY (DEG/SEC.)		
TIME(SEC.)	X	Y	Z	X	Y	Z
0.00000	0.000	0.000	12161.000	0.000	0.000	0.000
2.30000	0.000	0.000	12161.000	0.000	0.000	0.000
4.60000	0.000	0.000	12161.000	0.000	0.000	0.000

VEHICLE LINEAR TIME HISTORY CONSTANT WIND VELOCITY OF 600 KNOTS

TIME	LINEAR DECELERATIONS (G'S)			LINEAR VELOCITIES (IN./SEC.)			LINEAR DISPLACEMENTS (IN.)		
(MSEC)	X	Y	Z	X	Y	Z	X	Y	Z
0.000	0.000	0.000	0.000	0.000	0.000	12161.000	0.000	0.000	0.000
2300.000	0.000	0.000	0.000	0.000	0.000	12161.000	0.000	0.000	27970.300
4600.000	0.000	0.000	0.000	0.000	0.000	12161.000	0.000	0.000	55940.600

VEHICLE ANGULAR TIME HISTORY CONSTANT WIND VELOCITY OF 600 KNOTS

TIME	ANGULAR ACCELERATIONS (DEG/SEC.**2)			ANGULAR VELOCITIES (DEG/SEC.)			ANGULAR DISPLACEMENTS (DEG)		
(MSEC)	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2300.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4600.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

NPL	NBLT	NBAG	NELP	NQ	NSD	NHRNSS	NWINDF	NJNTF	NFORCE	
1	0	0	0	0	0	0	1	0	0	CARD D.1

PLANE INPUTS CARDS D.2

PLANE NO. 1 WIND PLANE

	X	Y	Z
POINT 1	10.0000	10.0000	5.0000
POINT 2	-10.0000	10.0000	5.0000
POINT 3	10.0000	-10.0000	5.0000

BODY SEGMENT SYMMETRY INPUT CARD D.7

SEG NO.	1	2
NSYM(J)	0	0

SPEC. HEAT RATIO	SONIC VEL.	ABS. PRESS.	SEGMENT	REF. SEGMENT
1.4000	13404.0000	14.6960	1LARM	3VEH

SEGMENT-ELLIPSOID	SEGMENT-PLANE	WIND FORCE FUNCTION	DRAG COEFFICIENT FUNCTION	BLOCKING SEGMENTS-ELLIPSOID
-1 - 1	3 - 1	1	0	
LARM	VEH -WIND PLANE	WIND FORCE		2- 2
-2 - 2	3 - 1	1	0	
UARM	VEH -WIND PLANE	WIND FORCE		1- 1

CARD G.1

ZPLT(X)	ZPLT(Y)	ZPLT(Z)	I1	J1	I2	J2	I3	SPLT(1)	SPLT(2)	SPLT(3)
0.	0.	0.	0	0	0	0	1	10.00	6.00	1.00

INITIAL POSITIONS (INERTIAL REFERENCE) CARDS G.2

SEGMENT	LINEAR POSITION (IN.)			LINEAR VELOCITY (IN./SEC.)		
NO. SEG	X	Y	Z	X	Y	Z
1 LARM	0.66000	0.00000	-18.98000	0.00000	0.00000	0.00000
2 UARM	0.18467	0.00000	-5.36830	0.00000	0.00000	0.00000

INITIAL ANGULAR ROTATION AND VELOCITY CARDS G.3

SEGMENT	ANGULAR ROTATION (DEG)			ANGULAR VELOCITY (DEG/SEC.)						
NO. SEG	YAW	PITCH	ROLL	X	Y	Z	IYPR			
1 LARM	0.00000	-2.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
2 UARM	0.00000	-2.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0

TABULAR TIME HISTORY CONTROL PARAMETERS

TYPE	KSG	SELECTED SEGMENTS OR JOINTS		
H.1	0			
REF				
H.2	0			
REF				
H.3	3	1	2	2
REF		2	1	4
H.4	0			
REF				
H.5	0			
REF				
H.6	0			
REF				
H.7	1	1		
REF		0		
H.8	2	1	2	
REF		0	0	
H.9	1	1		
REF		1		

SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LARM	0.0000	-2.0000	0.0000	0.00000	0.00000	0.00000	0.000516	7.241005	-0.000467
2 UARM	0.0000	-2.0000	0.0000	0.00000	0.00000	0.00000	-0.000433	22.756386	0.000000
3 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LARM	0.6600	0.0000	-18.9800	0.00000	0.00000	0.00000	0.123940	0.000002	1.323803
2 UARM	0.1847	0.0000	-5.3683	0.00000	0.00000	0.00000	-0.131968	-0.000003	22.212406
3 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	12161.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1 LARM	0.0000E+00	0.0000E+00	0.5094E+03	0.85920E-03	-0.10774E+02	-0.46703E-03	0.00000E+00	0.00000E+00	0.00000E+00
2 UARM	0.0000E+00	0.0000E+00	0.8578E+04	-0.30574E-13	-0.46180E-14	-0.21433E-14	0.00000E+00	0.00000E+00	0.00000E+00
							TOTAL BODY KINETIC ENERGY		
							0.00000E+00	0.00000E+00	0.00000E+00

JOINT	IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1 ELBW	5	-0.731E+00	-0.139E-04	-0.255E-01	0.0000E+00	0.0000E+00	0.0000E+00	0.000

SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LARM	0.0000	-4.6324	0.0000	0.00002	-2.40848	0.00000	0.000697	-69.675443	0.000000
2 UARM	0.0000	1.9906	0.0000	-0.00004	2.43012	0.00000	-0.000080	-49.821585	-0.000001
3 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LARM	0.5275	0.0000	-13.8865	-7.63751	-0.00008	255.94533	-0.811909	-0.000008	17.016782
2 UARM	0.3258	0.0000	-3.6572	8.13242	0.00008	79.32710	0.864511	0.000009	3.974612
3 VEH	0.0000	0.0000	486.4400	0.00000	0.00000	12161.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1 LARM	0.2556E-02	0.2735E-12	0.6595E+04	0.87740E-07	0.83063E-12	-0.18158E-13	0.50106E+03	0.96612E+00	0.50203E+03
2 UARM	0.4615E-03	0.4939E-13	0.1508E+04	-0.15599E-02	0.98653E+02	-0.90086E-06	0.45639E+02	0.51466E+00	0.46153E+02
							TOTAL BODY KINETIC ENERGY		
							0.54670E+03	0.14808E+01	0.54818E+03

JOINT	IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1 ELBW	5	0.479E+01	0.481E-04	0.388E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.839

POSTPROCESSOR CONTROL PARAMETERS

	HIC & HSI POINT	CSI POINT
H.11	0	0

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND

VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

POINT REL. LINEAR DISPLACEMENT (IN.)

TIME	POINT (0.00, 0.00, 8.20) ON SEGMENT NO. 1 - LARM IN UARM REFERENCE				POINT (0.00, 0.00, -5.42) ON SEGMENT NO. 2 - UARM IN LARM REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 2 - UARM IN GRND REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	0.000	-5.420	5.420	0.000	0.000	8.200	8.200	0.185	0.000	-5.368	5.371
0.500	0.000	0.000	-5.420	5.420	0.000	0.000	8.200	8.200	0.185	0.000	-5.368	5.371
1.000	0.000	0.000	-5.419	5.419	0.000	0.000	8.199	8.199	0.185	0.000	-5.366	5.370
1.500	0.000	0.000	-5.417	5.417	0.000	0.000	8.197	8.197	0.185	0.000	-5.365	5.368
2.000	0.000	0.000	-5.414	5.414	0.000	0.000	8.194	8.194	0.185	0.000	-5.362	5.365
3.000	0.000	0.000	-5.405	5.405	0.000	0.000	8.185	8.185	0.185	0.000	-5.356	5.359
4.000	0.000	0.000	-5.392	5.392	0.000	0.000	8.172	8.172	0.186	0.000	-5.347	5.350
5.000	0.000	0.000	-5.375	5.375	0.000	0.000	8.155	8.155	0.187	0.000	-5.336	5.339
6.000	0.000	0.000	-5.354	5.354	0.000	0.000	8.134	8.134	0.187	0.000	-5.322	5.325
7.000	0.000	0.000	-5.329	5.329	0.000	0.000	8.109	8.109	0.188	0.000	-5.306	5.309
8.000	-0.001	0.000	-5.299	5.299	0.000	0.000	8.079	8.079	0.190	0.000	-5.288	5.291
9.000	-0.001	0.000	-5.266	5.266	0.000	0.000	8.046	8.046	0.191	0.000	-5.267	5.271
10.000	-0.002	0.000	-5.228	5.228	0.000	0.000	8.008	8.008	0.192	0.000	-5.245	5.249
11.000	-0.002	0.000	-5.185	5.185	0.000	0.000	7.965	7.965	0.194	0.000	-5.221	5.224
12.000	-0.003	0.000	-5.139	5.139	0.000	0.000	7.919	7.919	0.196	0.000	-5.194	5.198
13.000	-0.005	0.000	-5.088	5.088	0.000	0.000	7.868	7.868	0.198	0.000	-5.166	5.170
14.000	-0.006	0.000	-5.032	5.032	0.000	0.000	7.812	7.812	0.200	0.000	-5.135	5.139
15.000	-0.008	0.000	-4.973	4.973	0.000	0.000	7.753	7.753	0.202	0.000	-5.103	5.107
16.000	-0.011	0.000	-4.909	4.909	0.000	0.000	7.689	7.689	0.204	0.000	-5.068	5.073
17.000	-0.013	0.000	-4.840	4.841	0.000	0.000	7.620	7.620	0.207	0.000	-5.032	5.036
18.000	-0.017	0.000	-4.768	4.768	0.000	0.000	7.548	7.548	0.210	0.000	-4.993	4.998
19.000	-0.021	0.000	-4.691	4.691	0.000	0.000	7.471	7.471	0.213	0.000	-4.953	4.957
20.000	-0.026	0.000	-4.610	4.610	0.000	0.000	7.390	7.390	0.216	0.000	-4.910	4.915
21.000	-0.031	0.000	-4.525	4.525	0.000	0.000	7.304	7.304	0.219	0.000	-4.865	4.870
22.000	-0.038	0.000	-4.435	4.435	0.000	0.000	7.214	7.214	0.223	0.000	-4.819	4.824
23.000	-0.045	0.000	-4.341	4.341	0.000	0.000	7.120	7.120	0.227	0.000	-4.770	4.775
24.000	-0.053	0.000	-4.243	4.243	0.000	0.000	7.021	7.021	0.231	0.000	-4.719	4.725
25.000	-0.063	0.000	-4.140	4.141	0.000	0.000	6.919	6.919	0.235	0.000	-4.667	4.672
26.000	-0.073	0.000	-4.033	4.034	0.000	0.000	6.811	6.811	0.239	0.000	-4.612	4.618
27.000	-0.085	0.000	-3.922	3.923	0.000	0.000	6.700	6.700	0.244	0.000	-4.555	4.562
28.000	-0.098	0.000	-3.807	3.808	0.000	0.000	6.584	6.584	0.248	0.000	-4.496	4.503
29.000	-0.113	0.000	-3.687	3.689	0.000	0.000	6.464	6.464	0.254	0.000	-4.436	4.443
30.000	-0.129	0.000	-3.563	3.566	0.000	0.000	6.339	6.339	0.259	0.000	-4.373	4.381
31.000	-0.146	0.000	-3.435	3.438	0.000	0.000	6.209	6.209	0.264	0.000	-4.309	4.317
32.000	-0.165	0.000	-3.302	3.306	0.000	0.000	6.075	6.075	0.270	0.000	-4.243	4.252
33.000	-0.187	0.000	-3.164	3.170	0.000	0.000	5.937	5.937	0.276	0.000	-4.175	4.184
34.000	-0.209	0.000	-3.022	3.030	0.000	0.000	5.793	5.793	0.282	0.000	-4.106	4.115
35.000	-0.234	0.000	-2.876	2.885	0.000	0.000	5.645	5.645	0.289	0.000	-4.035	4.045
36.000	-0.261	0.000	-2.724	2.737	0.000	0.000	5.491	5.491	0.296	0.000	-3.962	3.973
37.000	-0.290	0.000	-2.568	2.584	0.000	0.000	5.333	5.333	0.303	0.000	-3.888	3.900
38.000	-0.320	0.000	-2.407	2.428	0.000	0.000	5.170	5.170	0.310	0.000	-3.813	3.825
39.000	-0.354	0.000	-2.241	2.269	0.000	0.000	5.002	5.002	0.318	0.000	-3.736	3.749
40.000	-0.389	0.000	-2.071	2.107	0.000	0.000	4.828	4.828	0.326	0.000	-3.657	3.672

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND

VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

JOINT PARAMETERS

JOINT NO. 1 - ELBW

TIME	STATE	JOINT ANGLES (DEG)			TOTAL TORQUE (IN. LB.)		
(MSEC)	IPIN	FLEXURE	AZIMUTH	TORSION	SPRING	VISCOUS	RES.
0.000	5.	67.190	180.000	0.000	0.000	0.000	0.000
0.500	5.	67.189	180.000	0.000	0.000	0.000	0.000
1.000	5.	67.186	180.000	0.000	0.000	0.000	0.000
1.500	5.	67.181	180.000	0.000	0.000	0.000	0.000
2.000	5.	67.172	180.000	0.000	0.000	0.000	0.000
3.000	5.	67.149	180.000	0.000	0.000	0.000	0.000
4.000	5.	67.116	180.000	0.000	0.000	0.000	0.000
5.000	5.	67.073	180.000	0.000	0.000	0.000	0.000
6.000	5.	67.021	180.000	0.000	0.000	0.000	0.000
7.000	5.	66.959	180.000	0.000	0.000	0.000	0.000
8.000	5.	66.888	180.000	0.000	0.000	0.000	0.000
9.000	5.	66.808	180.000	0.000	0.000	0.000	0.000
10.000	5.	66.720	180.000	0.000	0.000	0.000	0.000
11.000	5.	66.623	180.000	0.000	0.000	0.000	0.000
12.000	5.	66.517	180.000	0.000	0.000	0.000	0.000
13.000	5.	66.403	180.000	0.000	0.000	0.000	0.000
14.000	5.	66.280	180.000	0.000	0.000	0.000	0.000
15.000	5.	66.149	180.000	0.000	0.000	0.000	0.000
16.000	5.	66.010	180.000	0.000	0.000	0.000	0.000
17.000	5.	65.862	180.000	0.000	0.000	0.000	0.000
18.000	5.	65.706	180.000	0.000	0.000	0.000	0.000
19.000	5.	65.542	180.000	0.000	0.000	0.000	0.000
20.000	5.	65.369	180.000	0.000	0.000	0.000	0.000
21.000	5.	65.189	180.000	0.000	0.000	0.000	0.000
22.000	5.	65.001	180.000	0.000	0.000	0.000	0.000
23.000	5.	64.805	180.000	0.000	0.000	0.000	0.000
24.000	5.	64.601	180.000	0.000	0.000	0.000	0.000
25.000	5.	64.390	-180.000	0.000	0.000	0.000	0.000
26.000	5.	64.171	-180.000	0.000	0.000	0.000	0.000
27.000	5.	63.945	-180.000	0.000	0.000	0.000	0.000
28.000	5.	63.712	180.000	0.000	0.000	0.000	0.000
29.000	5.	63.473	180.000	0.000	0.000	0.000	0.000
30.000	5.	63.229	180.000	0.000	0.000	0.000	0.000
31.000	5.	62.978	180.000	0.000	0.000	0.000	0.000
32.000	5.	62.723	180.000	0.000	0.000	0.000	0.000
33.000	5.	62.462	180.000	0.000	0.000	0.000	0.000
34.000	5.	62.199	180.000	0.000	0.000	0.000	0.000
35.000	5.	61.932	180.000	0.000	0.000	0.000	0.000
36.000	5.	61.663	180.000	0.000	0.000	0.000	0.000
37.000	5.	61.392	180.000	0.000	0.000	0.000	0.000
38.000	5.	61.119	180.000	0.000	0.000	0.000	0.000
39.000	5.	60.844	180.000	0.000	0.000	0.000	0.000
40.000	5.	60.567	180.000	0.000	0.000	0.000	0.000

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND
VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT WIND FORCE (LB.)

TIME	SEGMENT NO. 1 - LARM IN GRND REFERENCE				SEGMENT NO. 2 - UARM IN GRND REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	0.000	1.885	1.885	0.000	0.000	117.585	117.585
0.500	0.000	0.000	92.335	92.335	0.000	0.000	28.783	28.783
1.000	0.000	0.000	92.288	92.288	0.000	0.000	28.768	28.768
1.500	0.000	0.000	92.242	92.242	0.000	0.000	28.752	28.752
2.000	0.000	0.000	92.198	92.198	0.000	0.000	28.735	28.735
3.000	0.000	0.000	92.112	92.112	0.000	0.000	28.702	28.702
4.000	0.000	0.000	92.032	92.032	0.000	0.000	28.667	28.667
5.000	0.000	0.000	91.958	91.958	0.000	0.000	28.632	28.632
6.000	0.000	0.000	91.888	91.888	0.000	0.000	28.595	28.595
7.000	0.000	0.000	91.824	91.824	0.000	0.000	23.798	23.798
8.000	0.000	0.000	91.766	91.766	0.000	0.000	23.765	23.765
9.000	0.000	0.000	91.713	91.713	0.000	0.000	23.733	23.733
10.000	0.000	0.000	91.666	91.666	0.000	0.000	23.699	23.699
11.000	0.000	0.000	91.624	91.624	0.000	0.000	23.666	23.666
12.000	0.000	0.000	91.589	91.589	0.000	0.000	23.632	23.632
13.000	0.000	0.000	91.560	91.560	0.000	0.000	23.597	23.597
14.000	0.000	0.000	91.538	91.538	0.000	0.000	23.563	23.563
15.000	0.000	0.000	91.523	91.523	0.000	0.000	23.529	23.529
16.000	0.000	0.000	91.515	91.515	0.000	0.000	23.494	23.494
17.000	0.000	0.000	91.515	91.515	0.000	0.000	23.460	23.460
18.000	0.000	0.000	91.524	91.524	0.000	0.000	23.427	23.427
19.000	0.000	0.000	91.541	91.541	0.000	0.000	23.394	23.394
20.000	0.000	0.000	91.567	91.567	0.000	0.000	23.361	23.361
21.000	0.000	0.000	91.602	91.602	0.000	0.000	23.330	23.330
22.000	0.000	0.000	91.648	91.648	0.000	0.000	23.299	23.299
23.000	0.000	0.000	91.704	91.704	0.000	0.000	23.269	23.269
24.000	0.000	0.000	91.772	91.772	0.000	0.000	23.240	23.240
25.000	0.000	0.000	91.852	91.852	0.000	0.000	23.213	23.213
26.000	0.000	0.000	91.944	91.944	0.000	0.000	23.187	23.187
27.000	0.000	0.000	92.050	92.050	0.000	0.000	23.162	23.162
28.000	0.000	0.000	92.169	92.169	0.000	0.000	20.825	20.825
29.000	0.000	0.000	92.303	92.303	0.000	0.000	20.806	20.806
30.000	0.000	0.000	92.452	92.452	0.000	0.000	20.789	20.789
31.000	0.000	0.000	92.616	92.616	0.000	0.000	20.773	20.773
32.000	0.000	0.000	92.798	92.798	0.000	0.000	20.759	20.759
33.000	0.000	0.000	92.996	92.996	0.000	0.000	16.136	16.136
34.000	0.000	0.000	93.211	93.211	0.000	0.000	16.127	16.127
35.000	0.000	0.000	93.444	93.444	0.000	0.000	16.120	16.120
36.000	0.000	0.000	93.695	93.695	0.000	0.000	16.113	16.113
37.000	0.000	0.000	93.966	93.966	0.000	0.000	16.108	16.108
38.000	0.000	0.000	94.257	94.257	0.000	0.000	16.103	16.103
39.000	0.000	0.000	94.569	94.569	0.000	0.000	16.100	16.100
40.000	0.000	0.000	94.903	94.903	0.000	0.000	16.097	16.097

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND
VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

ELBW JOINT FORCES & TORQUES ON UARM IN LARM REFERENCE

TIME	JOINT FORCE (LB. 10**2)			JOINT TORQUE (IN.- LB. 10**2)		
(MSEC)	X	Y	Z	X	Y	Z
0.000	-0.007	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
0.500	0.022	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
1.000	0.022	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
1.500	0.022	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
2.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
3.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
4.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
5.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
6.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
7.000	0.022	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
8.000	0.022	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
9.000	0.022	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
10.000	0.022	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
11.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
12.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
13.000	0.023	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
14.000	0.024	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
15.000	0.024	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
16.000	0.025	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
17.000	0.025	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
18.000	0.026	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
19.000	0.027	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
20.000	0.027	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
21.000	0.028	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
22.000	0.029	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
23.000	0.030	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
24.000	0.030	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
25.000	0.031	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
26.000	0.033	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
27.000	0.034	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
28.000	0.032	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
29.000	0.034	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
30.000	0.035	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
31.000	0.036	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
32.000	0.038	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
33.000	0.034	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
34.000	0.036	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
35.000	0.038	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
36.000	0.040	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
37.000	0.042	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
38.000	0.044	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
39.000	0.046	0.000	0.000	0.000E+00	0.000E+00	0.000E+00
40.000	0.048	0.000	0.000	0.000E+00	0.000E+00	0.000E+00

ELAPSED CPU TIME = 13.51 SECONDS

SUB	CALLS	TIME	%
MAIN3D	1	97	7.18
INPUT	1	49	3.63
CHAIN	170	18	1.33
EJOINT	170	0	0.00
DINT	21	77	5.70
PDAUX	211	71	5.26
DAUX	169	47	3.48
SETUP1	169	17	1.26
CONTCT	169	17	1.26
WINDY	338	684	50.63
VISPR	169	22	1.63
SETUP2	169	0	0.00
DAUX11	169	12	0.89
DAUX12	169	6	0.44
DAUX22	169	0	0.00
FSMSOL	169	11	0.81
OUTPUT	43	90	6.66
UPDATE	42	0	0.00
DZP	168	28	2.07
POSTPR	1	105	7.77
TOTAL		1351	100.00

APPENDIX D4

Example 2, ATB Dynamic Joint Test
Perkin-Elmer Output File

DEVELOPED BY CALSPAN CORP., P.O. BOX 400, BUFFALO NY 14225
AND BY J&J TECHNOLOGIES INC., ORCHARD PARK, NY 14127

FOR THE AIR FORCE ARMSTRONG AEROSPACE MEDICAL RESEARCH
LABORATORY, WRIGHT PATTERSON AIR FORCE BASE
UNDER CONTRACTS F33615-75C-5002,-78C-0516 AND -80C-05117

AND FOR THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION,
U.S. DEPARTMENT OF TRANSPORTATION, UNDER CONTRACTS
FH-11-7592, HS-053-2-485, HS-6-01300 AND "3-6-01410.

PROGRAM DOCUMENTATION: NHTSA REPORT NOS. DOT-HS-801-507
THROUGH 510 (FORMERLY CALSPAN REPORT NO. ZQ-5[illegible]0-L-1),
AVAILABLE FROM NTIS (ACCESSION NOS. PB-241692,3,4 AND 5),
APPENDIXES A-J TO THE ABOVE (AVAILABLE FROM CALSPAN),
AND REPORT NOS. AMRL-TR-75-14 (NTIS NO. AD-A014 816),
AFAMRL-TR-80-14 (NTIS NO. AD-A088 029), AND
AFAMRL-TR-83-073 (NTIS NO. AD-B079 184).

PROGRAM ATB-IV, EXECUTED ON THE AAMRL/BB CONCURRENT
3250 COMPUTER, WRIGHT-PATTERSON AFB, OHIO

FEB. 4, 1988 IRSIN= 0 IRSOUT= 0 RSTIME = 0.0000 CARDS A

EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND

UNITL = IN. UNITM = LB. UNITT = SEC. GRAVITY VECTOR = (0.0000, 0.0000, 386.0880) G = 386.0880

NDINT = 4 NSTEPS = 20 DT =0.002000 H0 =0.000500 HMAX =0.001000 HMIN =0.000063

NPRT ARRAY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	0	20	2	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1

CARD B.1
CARDS B.2

SEGMENT			WEIGHT	PRINCIPAL MOMENTS OF INERTIA (LB.-SEC.**2- IN.)			SEGMENT CONTACT ELLIPSOID SEMIAXES (IN.)			CENTER (IN.)			PRINCIPAL AXES (DEG)		
I	SYM	PLOT	(LB.)	X	Y	Z	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL
1	LARM	L	5.901	0.3331	0.3331	0.0214	1.871	1.871	10.269	0.000	0.000	0.000	0.00	0.00	0.00
2	UARM	U	5.542	0.1743	0.1743	0.0259	2.122	2.122	7.497	0.000	0.000	0.000	0.00	0.00	0.00

CARDS B.3

JOINT					LOCATION(IN.) - SEG(JNT)			LOCATION(IN.) - SEG(J+1)			PRIN. AXIS(DEG) - SEG(JNT)			PRIN. AXIS(DEG) - SEG(J+1)		
J	SYM	PLOT	JNT	PIN	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL	YAW	PITCH	ROLL
1	ELBW	E	1	5	0.000	0.000	8.200	0.000	0.000	-5.420	0.00	0.00	0.00	0.00	-67.19	0.00

UNLOCK CONDITIONS FOR SLIP JOINTS

JOINT	TENSION (LB.)	COMPRESSION (LB.)
1	0.000	0.000

CARDS B.4

FLEXURAL SPRING CHARACTERISTICS / TORSIONAL SPRING CHARACTERISTICS

JOINT	FLEXURAL SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)	TORSIONAL SPRING COEF. (IN. LB./DEG**J) LINEAR (J=1)	QUADRATIC (J=2)	CUBIC (J=3)	ENERGY DISSIPATION COEF.	JOINT STOP (DEG)
1 ELBW	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

CARDS B.5

JOINT VISCOUS CHARACTERISTICS AND LOCK-UNLOCK CONDITIONS

JOINT	VISCOUS COEFFICIENT (IN. LB.SEC./DEG)	COULOMB FRICTION COEF. (IN. LB.)	FULL FRICTION ANGULAR VELOCITY (DEG/SEC.)	MAX TORQUE FOR A LOCKED JOINT (IN. LB.)	MIN TORQUE FOR UNLOCKED JOINT (IN. LB.)	MIN. ANG. VELOCITY FOR UNLOCKED JOINT (RAD/SEC.)	IMPULSE RESTITUTION COEFFICIENT
1 ELBW	0.000	0.00	30.00	0.00	0.00	0.00	0.000

SEGMENT INTEGRATION CONVERGENCE TEST INPUT

SEGMENT NO. SYM	ANGULAR VELOCITIES (RAD/SEC.) MAG. TEST	ABS. ERROR	REL. ERROR	LINEAR VELOCITIES (IN./SEC.) MAG. TEST	ABS. ERROR	REL. ERROR	ANGULAR ACCELERATIONS (RAD/SEC.**2) MAG. TEST	ABS. ERROR	REL. ERROR	LINEAR ACCELERATIONS (IN./SEC.**2) MAG. TEST	ABS. ERROR	REL. ERROR
1 LARM	0.000	0.000	0.0000	0.000	0.000	0.0000	0.010	0.010	0.0010	0.001	0.001	0.0010
2 UARM	0.000	0.000	0.0000	0.000	0.000	0.0000	0.010	0.010	0.0010	0.000	0.000	0.0000

VEHICLE DECELERATION INPUTS

CONSTANT WIND VELOCITY OF 600 KNOTS

YAW	PITCH	ROLL	VIPS	VTIME	XO(X)	XO(Y)	XO(Z)	NATAB	ATO	ADT	MSEG
0.000	0.000	0.000	12161.000	0.000	0.000	0.000	0.000	-3	0.000000	2.300000	0

SPLINE FIT TABULAR INPUT

LTYPE = 2 LFIT = 1 NPTS = 3

INITIAL LINEAR POSITION (IN.) INITIAL ANGULAR POSITION (DEG)

TIME(SEC.)= 0.0000 X= 0.000 Y= 0.000 Z= 0.000 X= 0.000 Y= 0.000 Z= 0.000

	LINEAR VELOCITY (IN./SEC.)			ANGULAR VELOCITY (DEG/SEC.)		
TIME(SEC.)	X	Y	Z	X	Y	Z
0.00000	0.000	0.000	12161.000	0.000	0.000	0.000
2.30000	0.000	0.000	12161.000	0.000	0.000	0.000
4.60000	0.000	0.000	12161.000	0.000	0.000	0.000

VEHICLE LINEAR TIME HISTORY CONSTANT WIND VELOCITY OF 600 KNOTS

TIME	LINEAR DECELERATIONS (G'S)			LINEAR VELOCITIES (IN./SEC.)			LINEAR DISPLACEMENTS (IN.)		
(MSEC)	X	Y	Z	X	Y	Z	X	Y	Z
0.000	0.000	0.000	0.000	0.000	0.000	12161.000	0.000	0.000	0.000
2300.000	0.000	0.000	0.000	0.000	0.000	12161.000	0.000	0.000	27970.300
4600.000	0.000	0.000	0.000	0.000	0.000	12161.000	0.000	0.000	55940.600

VEHICLE ANGULAR TIME HISTORY CONSTANT WIND VELOCITY OF 600 KNOTS

TIME	ANGULAR ACCELERATIONS (DEG/SEC.**2)			ANGULAR VELOCITIES (DEG/SEC.)			ANGULAR DISPLACEMENTS (DEG)		
(MSEC)	X	Y	Z	X	Y	Z	YAW	PITCH	ROLL
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2300.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4600.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

NPL	NBLT	NBAG	NELP	NQ	NSD	NHRNSS	NWINDF	NJNTF	NFORCE
1	0	0	0	0	0	0	1	0	0

CARD D.1

PLANE INPUTS

CARDS D.2

PLANE NO. 1 WIND PLANE

	X	Y	Z
POINT 1	10.0000	10.0000	5.0000
POINT 2	-10.0000	10.0000	5.0000
POINT 3	10.0000	-10.0000	5.0000

BODY SEGMENT SYMMETRY INPUT

CARD D.7

SEG NO.	1	2
NSYM(J)	0	0

SPEC. HEAT RATIO	SONIC VEL.	ABS. PRESS.	SECMENT	REF. SEGMENT
1.4000	13404.0000	14.6960	1LARM	3VEH

SEGMENT-ELLIPSOID	SEGMENT-PLANE	WIND FORCE FUNCTION	DRAG COEFFICIENT FUNCTION	BLOCKING SEGMENTS-ELLIPSOID
-1 - 1	3 - 1	1	0	
LARM	VEH -WIND PLANE	WIND FORCE		2- 2
-2 - 2	3 - 1	1	0	
UARM	VEH -WIND PLANE	WIND FORCE		1- 1

CARD G.1

ZPLT(X)	ZPLT(Y)	ZPLT(Z)	I1	J1	I2	J2	I3	SPLT(1)	SPLT(2)	SPLT(3)
0.	0.	0.	0	0	0	0	1	10.00	6.00	1.00

INITIAL POSITIONS (INERTIAL REFERENCE)

CARDS G.2

SEGMENT		LINEAR POSITION (IN.)			LINEAR VELOCITY (IN./SEC.)	
NO.	SEG	X	Y	Z	X	Y	Z
1	LARM	0.66000	0.00000	-18.98000	0.00000	0.00000	0.00000
2	UARM	0.18467	0.00000	-5.36830	0.00000	0.00000	0.00000

INITIAL ANGULAR ROTATION AND VELOCITY

CARDS G.3

SEGMENT		ANGULAR ROTATION (DEG)			ANGULAR VELOCITY (DEG/SEC.)						
NO.	SEG	YAW	PITCH	ROLL	X	Y	Z	IYPR			
1	LARM	0.00000	-2.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0
2	UARM	0.00000	-2.00000	0.00000	0.00000	0.00000	0.00000	3	2	1	0

TABULAR TIME HISTORY CONTROL PARAMETERS

TYPE	KSG	SELECTED SEGMENTS OR JOINTS		
H.1	0			
REF				
H.2	0			
REF				
H.3	3	1	2	2
REF		2	1	4
H.4	0			
REF				
H.5	0			
REF				
H.6	0			
REF				
H.7	1	1		
REF		0		
H.8	2	1	2	
REF		0	0	
H.9	1	1		
REF		1		

SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LARM	0.0000	-2.0000	0.0000	0.00000	0.00000	0.00000	0.000348	7.240952	-0.000315
2 UARM	0.0000	-2.0000	0.0000	0.00000	0.00000	0.00000	-0.000292	22.756331	0.000000
3 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LARM	0.6600	0.0000	-18.9800	0.00000	0.00000	0.00000	0.123940	0.000002	1.323803
2 UARM	0.1847	0.0000	-5.3683	0.00000	0.00000	0.00000	-0.131968	-0.000002	22.212334
3 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	12161.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1 LARM	0.0000D+00	0.0000D+00	0.5094D+03	0.57981D-03	-0.10774D+02	-0.31516D-03	0.000000D+00	0.000000D+00	0.000000D+00
2 UARM	0.0000D+00	0.0000D+00	0.8578D+04	-0.11465D-13	-0.38367D-14	-0.32149D-14	0.000000D+00	0.000000D+00	0.000000D+00
							TOTAL BODY KINETIC ENERGY		
							0.000000D+00	0.000000D+00	0.000000D+00

JOINT	IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1 ELBW	5	-0.731D+00	-0.941D-05	-0.255D-01	0.0000D+00	0.0000D+00	0.0000D+00	0.000

DINT CONV. TEST 1.000 LARM ANG ACC 3064. 0.4514E-02 0.1473E-05 0.1000E-03 0.1000E-03 0.1000E-05

TEST FAILED AT TIME = 0.001000 FOR H = 0.000500

SEGMENT	(INERTIAL) ANGULAR ROTATION (DEG) YAW	PITCH	ROLL	(LOCAL) ANGULAR VELOCITY (RAD/SEC.) X	Y	Z	(LOCAL) ANGULAR ACCELERATION (RAD/SEC.**2) X	Y	Z
1 LARM	0.0000	-4.6312	-0.0023	-0.00364	-2.40686	0.00000	-0.109497	-69.644370	0.000000
2 UARM	0.0000	1.9884	0.0050	0.03666	2.42783	-0.00004	0.012320	-49.752471	-0.000001
3 VEH	0.0000	0.0000	0.0000	0.00000	0.00000	0.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) LINEAR POSITION (IN.) X	Y	Z	(INERTIAL) LINEAR VELOCITY (IN./SEC.) X	Y	Z	(INERTIAL) LINEAR ACCELERATIONS (G'S) X	Y	Z
1 LARM	0.5275	0.0001	-13.8864	-7.63222	0.01244	255.94443	-0.811510	0.001280	17.016222
2 UARM	0.3257	-0.0001	-3.6569	8.12663	-0.01319	79.35888	0.864086	-0.001363	3.974519
3 VEH	0.0000	0.0000	486.4400	0.00000	0.00000	12161.00000	0.000000	0.000000	0.000000

SEGMENT	(INERTIAL) U1 ARRAY (IN./SEC.**2) EXTERNAL LINEAR ACCELERATIONS X	Y	Z	(LOCAL) U2 ARRAY (RAD/SEC.**2) EXTERNAL ANGULAR ACCELERATIONS X	Y	Z	KINETIC ENERGY (LB.- IN.) LINEAR	ANGULAR	TOTAL
1 LARM	0.2552D-02	-0.6775D-08	0.6595D+04	0.59166D-07	-0.89447D-10	0.11024D-13	0.50106D+03	0.96483D+00	0.50202D+03
2 UARM	0.4609D-03	-0.1224D-08	0.1507D+04	0.24577D+00	0.98650D+02	-0.88356D-06	0.45674D+02	0.51370D+00	0.46188D+02
							TOTAL BODY KINETIC ENERGY		
							0.54673D+03	0.14785D+01	0.54821D+03

JOINT	IPIN	(INERTIAL) JOINT FORCES (LB.) X	Y	Z	(INERTIAL) JOINT TORQUES (IN. LB.) X	Y	Z	RELATIVE ANGULAR VELOCITY (RAD/SEC.)
1 ELBW	5	0.479D+01	-0.755D-02	0.388D+00	0.0000D+00	0.0000D+00	0.0000D+00	4.835

POSTPROCESSOR CONTROL PARAMETERS

	NIC & NSI POINT	CSI POINT
N.11	0	0

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND
VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

PAGE: 21.01

POINT REL. LINEAR DISPLACEMENT (IN.)

TIME	POINT (0.00, 0.00, 8.20) ON SEGMENT NO. 1 - LARM IN UARM REFERENCE				POINT (0.00, 0.00, -5.42) ON SEGMENT NO. 2 - UARM IN LARM REFERENCE				POINT (0.00, 0.00, 0.00) ON SEGMENT NO. 2 - UARM IN GRND REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	0.000	-5.420	5.420	0.000	0.000	8.200	8.200	0.185	0.000	-5.368	5.371
0.500	0.000	0.000	-5.420	5.420	0.000	0.000	8.200	8.200	0.185	0.000	-5.368	5.371
0.750	0.000	0.000	-5.420	5.420	0.000	0.000	8.200	8.200	0.185	0.000	-5.367	5.370
1.000	0.000	0.000	-5.419	5.419	0.000	0.000	8.199	8.199	0.185	0.000	-5.366	5.370
1.500	0.000	0.000	-5.417	5.417	0.000	0.000	8.197	8.197	0.185	0.000	-5.365	5.368
2.000	0.000	0.000	-5.414	5.414	0.000	0.000	8.194	8.194	0.185	0.000	-5.362	5.366
3.000	0.000	0.000	-5.405	5.405	0.000	0.000	8.185	8.185	0.185	0.000	-5.356	5.359
4.000	0.000	0.000	-5.392	5.392	0.000	0.000	8.172	8.172	0.186	0.000	-5.347	5.350
5.000	0.000	0.000	-5.375	5.375	0.000	0.000	8.155	8.155	0.187	0.000	-5.336	5.339
6.000	0.000	0.000	-5.354	5.354	0.000	0.000	8.134	8.134	0.187	0.000	-5.322	5.325
7.000	0.000	0.000	-5.329	5.329	0.000	0.000	8.109	8.109	0.188	0.000	-5.306	5.309
8.000	-0.001	0.000	-5.299	5.299	0.000	0.000	8.079	8.079	0.190	0.000	-5.288	5.291
9.000	-0.001	0.000	-5.266	5.266	0.000	0.000	8.046	8.046	0.191	0.000	-5.268	5.271
10.000	-0.002	0.000	-5.228	5.228	0.000	0.000	8.008	8.008	0.192	0.000	-5.245	5.249
11.000	-0.002	0.000	-5.185	5.185	0.000	0.000	7.965	7.965	0.194	0.000	-5.221	5.224
12.000	-0.003	0.000	-5.138	5.138	0.000	0.000	7.918	7.918	0.196	0.000	-5.194	5.198
13.000	-0.005	0.000	-5.087	5.087	0.000	0.000	7.867	7.867	0.198	0.000	-5.166	5.170
14.000	-0.006	0.000	-5.032	5.032	0.000	0.000	7.812	7.812	0.200	0.000	-5.136	5.139
15.000	-0.008	0.000	-4.973	4.973	0.000	0.000	7.752	7.752	0.202	0.000	-5.103	5.107
16.000	-0.011	0.000	-4.909	4.909	0.000	0.000	7.688	7.688	0.204	0.000	-5.069	5.073
17.000	-0.013	0.000	-4.840	4.840	0.000	0.000	7.620	7.620	0.207	0.000	-5.032	5.036
18.000	-0.017	0.000	-4.768	4.768	0.000	0.000	7.548	7.548	0.210	0.000	-4.993	4.998
19.000	-0.021	0.000	-4.691	4.691	0.000	0.000	7.471	7.471	0.213	0.000	-4.953	4.957
20.000	-0.026	0.000	-4.610	4.610	0.000	0.000	7.389	7.389	0.216	0.000	-4.910	4.915
21.000	-0.031	0.000	-4.524	4.524	0.000	0.000	7.304	7.304	0.219	0.000	-4.865	4.870
22.000	-0.038	0.000	-4.435	4.435	0.000	0.000	7.214	7.214	0.223	0.000	-4.819	4.824
23.000	-0.045	0.000	-4.341	4.341	0.000	0.000	7.120	7.120	0.227	0.000	-4.770	4.775
24.000	-0.053	0.000	-4.242	4.243	0.000	0.000	7.021	7.021	0.231	0.000	-4.719	4.725
25.000	-0.063	0.000	-4.140	4.140	0.000	0.000	6.918	6.918	0.235	0.000	-4.667	4.673
26.000	-0.073	0.000	-4.033	4.034	0.000	0.000	6.811	6.811	0.239	0.000	-4.612	4.618
27.000	-0.085	0.000	-3.922	3.923	0.000	0.000	6.700	6.700	0.244	0.000	-4.555	4.562
28.000	-0.098	0.000	-3.807	3.808	0.000	0.000	6.584	6.584	0.248	0.000	-4.496	4.503
29.000	-0.113	0.000	-3.687	3.689	0.000	0.000	6.464	6.464	0.254	0.000	-4.436	4.443
30.000	-0.129	0.000	-3.563	3.565	0.000	0.000	6.339	6.339	0.259	0.000	-4.373	4.381
31.000	-0.146	0.000	-3.435	3.438	0.000	0.000	6.209	6.209	0.264	0.000	-4.309	4.317
32.000	-0.165	0.000	-3.302	3.306	0.000	0.000	6.075	6.075	0.270	0.000	-4.243	4.251
33.000	-0.186	0.000	-3.164	3.170	0.000	0.000	5.937	5.937	0.276	0.000	-4.175	4.184
34.000	-0.209	0.000	-3.022	3.030	0.000	0.000	5.793	5.793	0.282	0.000	-4.105	4.115
35.000	-0.234	0.000	-2.876	2.885	0.000	0.000	5.645	5.645	0.289	0.000	-4.035	4.045
36.000	-0.261	0.000	-2.724	2.737	0.000	0.000	5.492	5.492	0.296	0.000	-3.962	3.973
37.000	-0.289	0.000	-2.568	2.584	0.000	0.000	5.333	5.333	0.303	0.000	-3.888	3.900
38.000	-0.320	0.000	-2.407	2.428	0.000	0.000	5.170	5.170	0.310	0.000	-3.813	3.825
39.000	-0.353	0.000	-2.241	2.269	0.000	0.000	5.002	5.002	0.318	0.000	-3.735	3.749
40.000	-0.389	0.000	-2.071	2.107	0.000	0.000	4.829	4.829	0.326	0.000	-3.657	3.671

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND
VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

JOINT PARAMETERS

JOINT NO. 1 - ELBW

TIME	STATE	JOINT ANGLES (DEG)			TOTAL TORQUE (IN. LB.)		
(MSEC)	IPIN	FLEXURE	AZIMUTH	TORSION	SPRING	VISCOUS	RES.
0.000	5.	67.190	180.000	0.000	0.000	0.000	0.000
0.500	5.	67.189	180.000	0.000	0.000	0.000	0.000
0.750	5.	67.188	-180.000	0.000	0.000	0.000	0.000
1.000	5.	67.186	-180.000	0.000	0.000	0.000	0.000
1.500	5.	67.180	-180.000	0.000	0.000	0.000	0.000
2.000	5.	67.172	-180.000	0.000	0.000	0.000	0.000
3.000	5.	67.149	-180.000	0.000	0.000	0.000	0.000
4.000	5.	67.116	-180.000	0.000	0.000	0.000	0.000
5.000	5.	67.073	-180.000	0.000	0.000	0.000	0.000
6.000	5.	67.021	-180.000	0.000	0.000	0.000	0.000
7.000	5.	66.959	-180.000	0.000	0.000	0.000	0.000
8.000	5.	66.888	-180.000	0.000	0.000	0.000	0.000
9.000	5.	66.808	-180.000	0.000	0.000	0.000	0.000
10.000	5.	66.720	-180.000	0.000	0.000	0.000	0.000
11.000	5.	66.623	-180.000	0.000	0.000	0.000	0.000
12.000	5.	66.517	-180.000	0.000	0.000	0.000	0.000
13.000	5.	66.403	-180.000	0.000	0.000	0.000	0.000
14.000	5.	66.280	-180.000	0.000	0.000	0.000	0.000
15.000	5.	66.149	-180.000	0.000	0.000	0.000	0.000
16.000	5.	66.010	-180.000	0.000	0.000	0.000	0.000
17.000	5.	65.862	-180.000	0.000	0.000	0.000	0.000
18.000	5.	65.706	-180.000	0.000	0.000	0.000	0.000
19.000	5.	65.542	-180.000	0.000	0.000	0.000	0.000
20.000	5.	65.369	-180.000	0.000	0.000	0.000	0.000
21.000	5.	65.189	-180.000	0.000	0.000	0.000	0.000
22.000	5.	65.001	-180.000	0.000	0.000	0.000	0.000
23.000	5.	64.805	-180.000	0.000	0.000	0.000	0.000
24.000	5.	64.601	-180.000	0.000	0.000	0.000	0.000
25.000	5.	64.390	-180.000	0.000	0.000	0.000	0.000
26.000	5.	64.171	-180.000	0.000	0.000	0.000	0.000
27.000	5.	63.945	-180.000	0.000	0.000	0.000	0.000
28.000	5.	63.713	-180.000	-0.001	0.000	0.000	0.000
29.000	5.	63.474	-179.999	-0.001	0.000	0.000	0.000
30.000	5.	63.230	-179.999	-0.001	0.000	0.000	0.000
31.000	5.	62.980	-179.999	-0.002	0.000	0.000	0.000
32.000	5.	62.724	-179.999	-0.002	0.000	0.000	0.000
33.000	5.	62.464	-179.998	-0.002	0.000	0.000	0.000
34.000	5.	62.200	-179.998	-0.003	0.000	0.000	0.000
35.000	5.	61.934	-179.998	-0.003	0.000	0.000	0.000
36.000	5.	61.666	-179.998	-0.003	0.000	0.000	0.000
37.000	5.	61.395	-179.997	-0.004	0.000	0.000	0.000
38.000	5.	61.122	-179.997	-0.004	0.000	0.000	0.000
39.000	5.	60.847	-179.997	-0.004	0.000	0.000	0.000
40.000	5.	60.570	-179.996	-0.005	0.000	0.000	0.000

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND
VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

SEGMENT WIND FORCE (LB.)

TIME	SEGMENT NO. 1 - LARM IN GRND REFERENCE				SEGMENT NO. 2 - UARM IN GRND REFERENCE			
(MSEC)	X	Y	Z	RES	X	Y	Z	RES
0.000	0.000	0.000	1.885	1.885	0.000	0.000	117.584	117.584
0.500	0.000	0.000	92.336	92.336	0.000	0.000	28.783	28.783
0.750	0.000	0.000	92.311	92.311	0.000	0.000	28.775	28.775
1.000	0.000	0.000	92.288	92.288	0.000	0.000	28.768	28.768
1.500	0.000	0.000	92.242	92.242	0.000	0.000	28.752	28.752
2.000	0.000	0.000	92.198	92.198	0.000	0.000	28.735	28.735
3.000	0.000	0.000	92.112	92.112	0.000	0.000	28.702	28.702
4.000	0.000	0.000	92.032	92.032	0.000	0.000	28.667	28.667
5.000	0.000	0.000	91.958	91.958	0.000	0.000	28.632	28.632
6.000	0.000	0.000	91.888	91.888	0.000	0.000	28.595	28.595
7.000	0.000	0.000	91.825	91.825	0.000	0.000	23.798	23.798
8.000	0.000	0.000	91.766	91.766	0.000	0.000	23.765	23.765
9.000	0.000	0.000	91.713	91.713	0.000	0.000	23.733	23.733
10.000	0.000	0.000	91.666	91.666	0.000	0.000	23.699	23.699
11.000	0.000	0.000	91.624	91.624	0.000	0.000	23.666	23.666
12.000	0.000	0.000	91.589	91.589	0.000	0.000	23.632	23.632
13.000	0.000	0.000	91.560	91.560	0.000	0.000	23.597	23.597
14.000	0.000	0.000	91.538	91.538	0.000	0.000	23.563	23.563
15.000	0.000	0.000	91.523	91.523	0.000	0.000	23.529	23.529
16.000	0.000	0.000	91.516	91.516	0.000	0.000	23.494	23.494
17.000	0.000	0.000	91.516	91.516	0.000	0.000	23.460	23.460
18.000	0.000	0.000	91.524	91.524	0.000	0.000	23.427	23.427
19.000	0.000	0.000	91.541	91.541	0.000	0.000	23.394	23.394
20.000	0.000	0.000	91.567	91.567	0.000	0.000	23.361	23.361
21.000	0.000	0.000	91.602	91.602	0.000	0.000	23.330	23.330
22.000	0.000	0.000	91.648	91.648	0.000	0.000	23.299	23.299
23.000	0.000	0.000	91.704	91.704	0.000	0.000	23.269	23.269
24.000	0.000	0.000	91.772	91.772	0.000	0.000	23.240	23.240
25.000	0.000	0.000	91.852	91.852	0.000	0.000	23.213	23.213
26.000	0.000	0.000	91.944	91.944	0.000	0.000	23.187	23.187
27.000	0.000	0.000	92.050	92.050	0.000	0.000	23.162	23.162
28.000	0.000	0.000	92.169	92.169	0.000	0.000	20.825	20.825
29.000	0.000	0.000	92.303	92.303	0.000	0.000	20.806	20.806
30.000	0.000	0.000	92.451	92.451	0.000	0.000	20.789	20.789
31.000	0.000	0.000	92.615	92.615	0.000	0.000	20.773	20.773
32.000	0.000	0.000	92.796	92.796	0.000	0.000	20.758	20.758
33.000	0.000	0.000	92.994	92.994	0.000	0.000	16.136	16.136
34.000	0.000	0.000	93.209	93.209	0.000	0.000	16.127	16.127
35.000	0.000	0.000	93.442	93.442	0.000	0.000	16.119	16.119
36.000	0.000	0.000	93.693	93.693	0.000	0.000	16.113	16.113
37.000	0.000	0.000	93.963	93.963	0.000	0.000	16.108	16.108
38.000	0.000	0.000	94.254	94.254	0.000	0.000	16.103	16.103
39.000	0.000	0.000	94.566	94.566	0.000	0.000	16.100	16.100
40.000	0.000	0.000	94.900	94.900	0.000	0.000	16.097	16.097

DATE: FEB. 4, 1988
RUN DESCRIPTION: EXAMPLE 2: DYNAMIC JOINT TEST
SLIP JOINT ' 600 KNOT WIND
PAGE: 24.01
VEHICLE DECELERATION: CONSTANT WIND VELOCITY OF 600 KNOTS
CRASH VICTIM: 95TH PERCENTILE MALE

ELBW JOINT FORCES & TORQUES ON UARM IN LARM REFERENCE

TIME	JOINT FORCE (LB. 10**2)			JOINT TORQUE (IN.- LB. 10**2)		
(MSEC)	X	Y	Z	X	Y	Z
0.000	-0.007	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
0.500	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
0.750	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
1.000	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
1.500	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
2.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
3.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
4.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
5.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
6.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
7.000	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
8.000	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
9.000	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
10.000	0.022	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
11.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
12.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
13.000	0.023	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
14.000	0.024	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
15.000	0.024	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
16.000	0.025	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
17.000	0.025	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
18.000	0.026	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
19.000	0.027	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
20.000	0.027	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
21.000	0.028	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
22.000	0.029	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
23.000	0.030	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
24.000	0.030	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
25.000	0.031	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
26.000	0.032	-0.002	0.000	0.0000+00	0.0000+00	0.0000+00
27.000	0.034	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
28.000	0.032	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
29.000	0.034	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
30.000	0.035	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
31.000	0.036	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
32.000	0.038	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
33.000	0.034	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
34.000	0.036	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
35.000	0.038	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
36.000	0.040	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
37.000	0.041	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
38.000	0.044	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
39.000	0.046	0.000	0.000	0.0000+00	0.0000+00	0.0000+00
40.000	0.048	0.000	0.000	0.0000+00	0.0000+00	0.0000+00

ELAPSED CPU TIME = 30.91 SECONDS

SUB	CALLS	TIME	%
MAIN3D	1	47	1.52
INPUT	1	44	1.42
CHAIN	192	37	1.20
EJOINT	192	3	0.10
DINT	21	143	4.63
PDAUX	234	123	3.98
DAUX	191	86	2.78
SETUP1	191	46	1.49
CONTCT	191	22	0.71
WINDY	382	2109	68.23
VISPR	191	72	2.33
SETUP2	191	6	0.19
DAUX11	191	31	1.00
DAUX12	191	1	0.03
DAUX22	191	9	0.29
FSMSOL	191	22	0.71
OUTPUT	44	79	2.56
UPDATE	43	3	0.10
DZP	190	42	1.36
POSTPR	1	166	5.37
TOTAL		3091	100.00

APPENDIX E1

Example 2, ATB Dynamic Joint Test
Input File with Plotting Options (EX2PLOT.AIN)

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FEB. 4, 1988   0   0     0.0                                                CARD A1A
EXAMPLE 2:  DYNAMIC JOINT TEST
SLIP JOINT / 600 KNOT WIND
 IN. LB.SEC.          0.0          0.0     386.088          0.0             CARD A3
   4  20   0.002  0.0005   0.001 .000063                                    CARD A4
 1 020 3 1 1 1 0 0 0 0 0 0 0 0 0 0 016 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 0 0 1CARD A5
    2     1          95TH PERCENTILE MALE                                   CARD B1
LARM L 5.901 .3331 .3331 .0214 1.871 1.87110.269 0.000 0.000 0.000          CARD B2A
UARM U 5.542 .1743 .1743 .0259 2.122 2.122 7.497 0.000 0.000 0.000          CARD B2A
ELBW E   1   5  0.00  0.00  8.20  0.00  0.00 -5.42   1  0.00  0.00          CARD B3A
                0.00  0.00  0.00  0.00-67.19  0.00
   .00   .00   .00   .00           .00   .00   .00   .00   .00          .00CARD B4
   0.0   0.0   30.   0.0   0.0                           0.0   0.0          CARD B5
   .00   .00   .00   .00   .00   .00   .01   .01  .001  .001  .001  .001CARD B6
   .00   .00   .00   .00   .00   .00   .01   .01  .001   .00   .00   .00CARD B6
CONSTANT WIND VELOCITY OF 600 KNOTS
   0.0   0.0   0.012161.  0.00  0.00  0.00  0.00    -3   0.0  2.30     0CARD C2A
     2     1     3                                                          CARD C2B
     0.000      0.000      0.000      0.000      0.000      0.000      0.000  CARD C5
     0.000      0.000      0.000 12161.000      0.000      0.000      0.000  CARD C5
     2.300      0.000      0.000 12161.000      0.000      0.000      0.000  CARD C5
     4.600      0.000      0.000 12161.000      0.000      0.000      0.000  CARD C5
     1     0     0     0     0     0     0     1     0     0               CARD D1
   1     WIND PLANE                                                          CARD D2A
        10.0          10.0          5.0                                      CARD D2B
       -10.0          10.0          5.0                                      CARD D2C
        10.0         -10.0          5.0                                      CARD D2D
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0                 CARD D7
 999                                                                         CARD E1
   1     WIND FORCE                                                          CARD E6A
      1.4000  13404.0000      14.6960            1            3              CARD E6B
   0                                                                         CARD F1A
   0   0                                                                     CARD F3A
   0                                                                         CARD F4A
   1   1                                                                     CARD F7A
  -1   1   3   1   1   0   1 2 2                                             CARD F7B
  -2   2   3   1   1   0   1 1 1                                             CARD F7B
       0.0        0.0        0.0   0   0   0   0   1                         CARD G1A
   0.66000   0.00000 -18.98000        0.0        0.0        0.0              CARD G2A
      0.00     -2.00      0.00      0.00      0.00      0.00  3  2  1  0CARD G3A
      0.00     -2.00      0.00      0.00      0.00      0.00  3  2  1  0CARD G3A
     0                                                                       CARD H1A
                                                                             CARD H1B
     0                                                                       CARD H2A
                                                                             CARD H2B
     3  2  1          0.0          0.0         8.20                          CARD H3A
        1  2          0.0          0.0        -5.42                          CARD H3B
        4  2          0.0          0.0          0.0                          CARD H3B
     0                                                                       CARD H4
     0                                                                       CARD H5
     0                                                                       CARD H6
     1     1                                                                 CARD H7
     2  0  1  0  2                                                           CARD H8
     1  1  1                                                                 CARD H9
     0                                                                       CARD H10
                                                                             CARD H11
   1   2                                                                     CARD I1
  21   0  21   4  21   8                                                     CARD I2
  10         0.0     ,0.0      9.0     10.0                                  CARD I3
  10         5.0     10.0      6.5      7.5                                  CARD I4
  10     TIME, MSEC                                                          CARD I5
  24     LINEAR DISPLACEMENT,  N.                                            CARD I6
  23     UPPER ARM AND LOWER ARM                                             CARD I7
  16     SEGMENTS 1 AND 2                                                    CARD I8
```
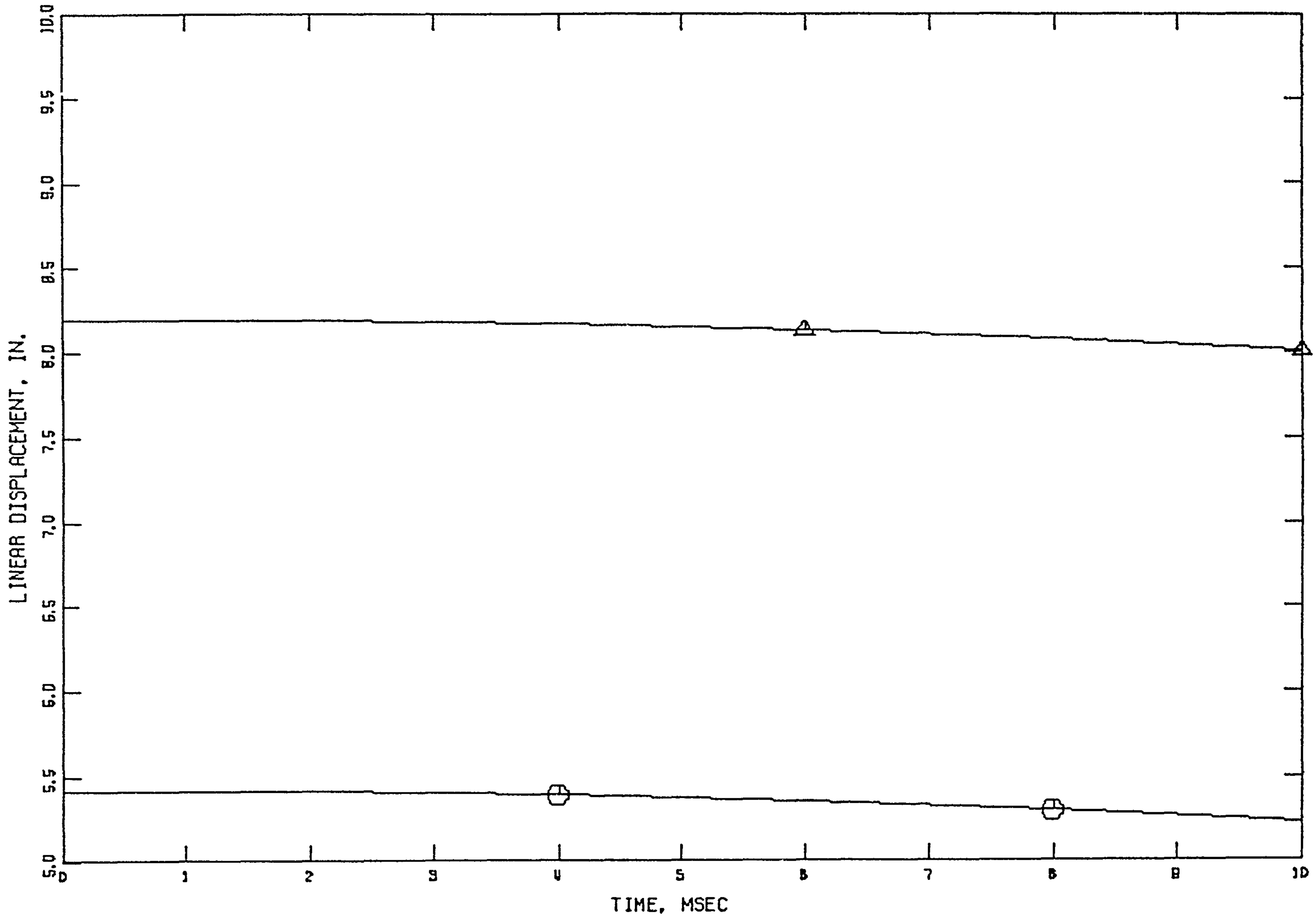

APPENDIX E2

Example 2, ATB Dynamic Joint Test X-Y Plot



UPPER ARM AND LOWER ARM
SEGMENTS 1 AND 2

APPENDIX E3

Example 2, ATB Dynamic Joint Test Printer Plot

T= 0.000 YO= 0.00000 ZO= 0.00000 Y-Z PLANE

T= 0.000 X0= 0.00000 Z0= 0.00000 X-Z PLANE

T= 0.000 X0= 0.00000 Y0= 0.00000 X-Y PLANE

T= 2.000 Y0= 0.00000 Z0= 24.32200 Y-Z PLANE

T= 2.000 X0= 0.00000 Z0= 24.32200 X-Z PLANE

L

T= 2.000 X0= 0.00000 Y0= 0.00000 X-Y PLANE

APPENDIX F1

Example 1, VIEW -- Input File (EXP1.VIN)

```
2
 1
                                    4
                                    4
                                    4
                                    4
  ATB COURSE EXAMPLE 1              4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4
                                    4

0.000     0.01000    .0800
0000
 0 016

 0
        2       2       2       2       2       2       2       2
        2       2       2       2       2       2       2       2
        2       2       2       2       2       2       2       2
        2       2       2       2       2       2       1       1
        1       1       3       1       1       3       3       1
        1       3       3       1       1       1       1       1
        1       1       1       1       1       1       1       1
        1       1       1       1       1       1       1       1
        1       1       1       1       1       1       1       1
        1       1       1       1       1       1       1       1
        1       1       1       1       1       1       1       1
        1       1
        4
 8 5 8 3 5 5 3 3 5 3 3 3 3 3 31010
202020202020202020202020202020202020202020202020202020202020
  4         110.00
       2.0       3.0
       0.0    1000.0     -20.0       0.0       0.0     -20.0        16         2
      0.00      9.00
```

APPENDIX F2

Example 1, VIEW -- 386 Output Listing (EXP1.VOU)

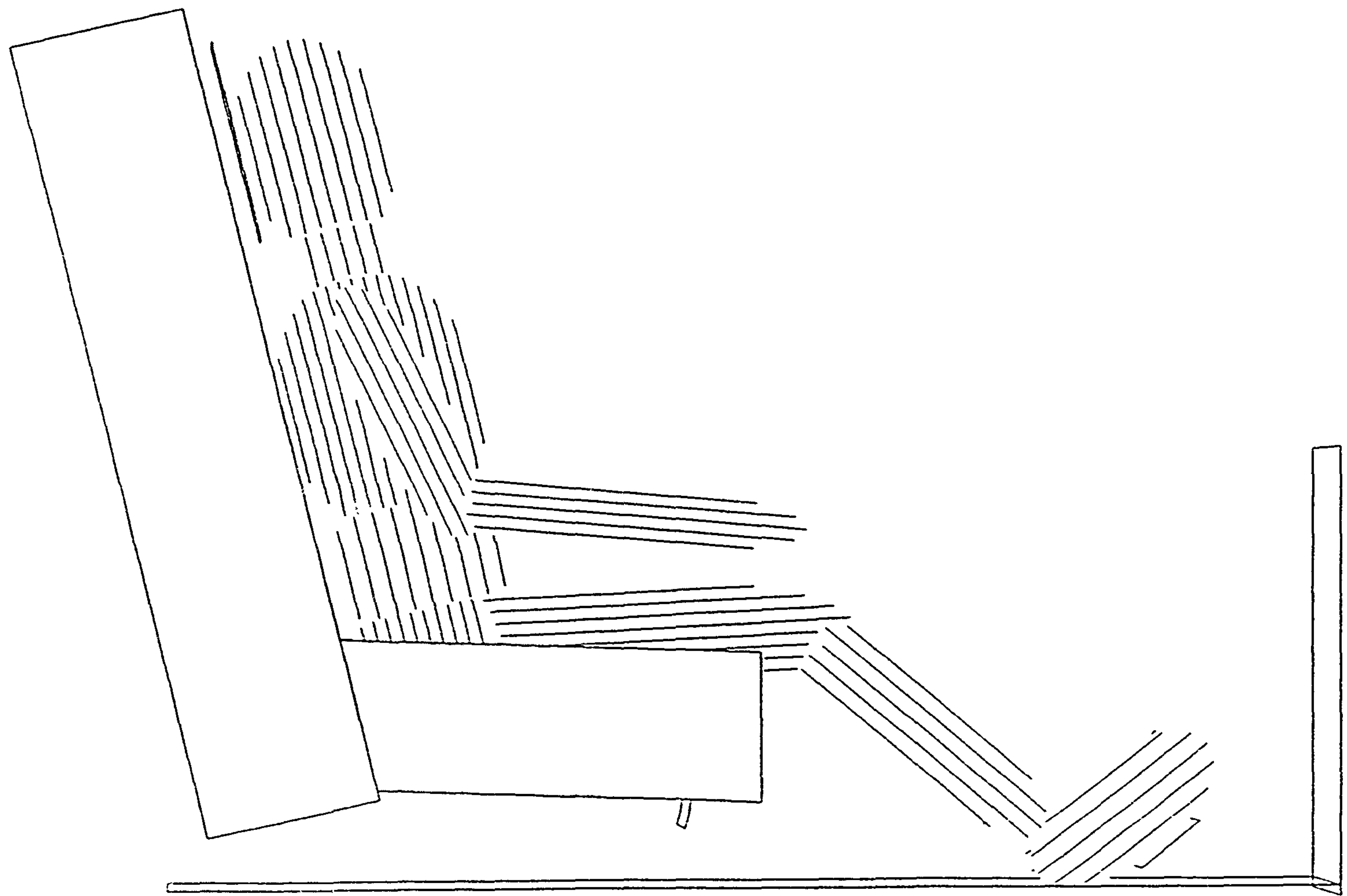
```
                                 4
                                 4
                                 4
                                 4
   ATB COURSE EXAMPLE 1          4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4

0000000000000000000000000000000000000000000000000000000000000000000000000000000
0 016

 4          110.00
      2.        3.
MAIN - PROCESSING FRAME #   1
XMIN,XMAX=      0.000      9.000
MAIN - PROCESSING FRAME #   2
MAIN - PROCESSING FRAME #   3
MAIN - PROCESSING FRAME #   4
MAIN - PROCESSING FRAME #   5
MAIN - PROCESSING FRAME #   6
MAIN - PROCESSING FRAME #   7
MAIN - PROCESSING FRAME #   8
MAIN - PROCESSING FRAME #   9
```

APPENDIX F3

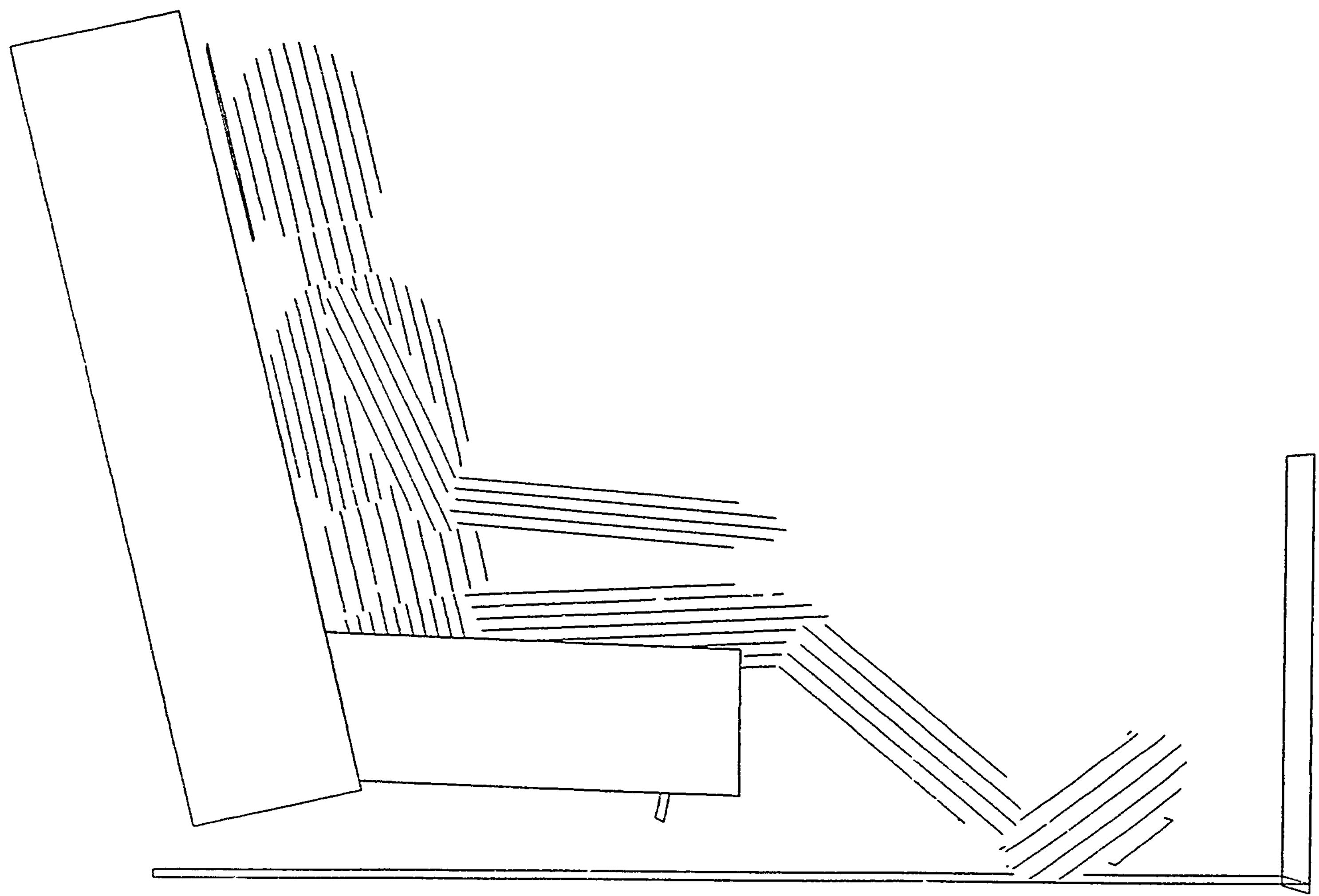
Example 1, VIEW -- 386 Output Graphics

ATB COURSE EXAMPLE 1

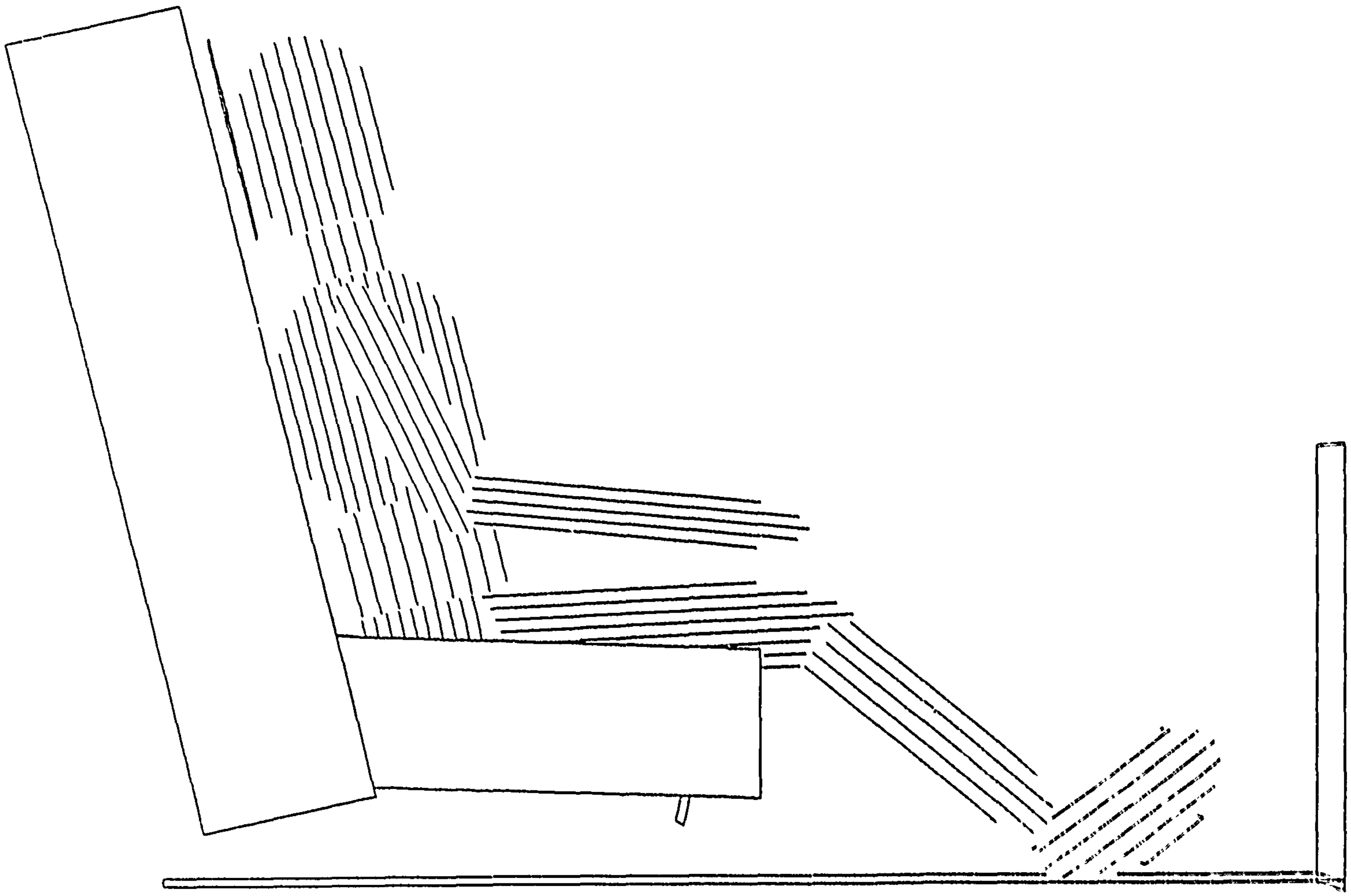
TIME (MSEC) 0



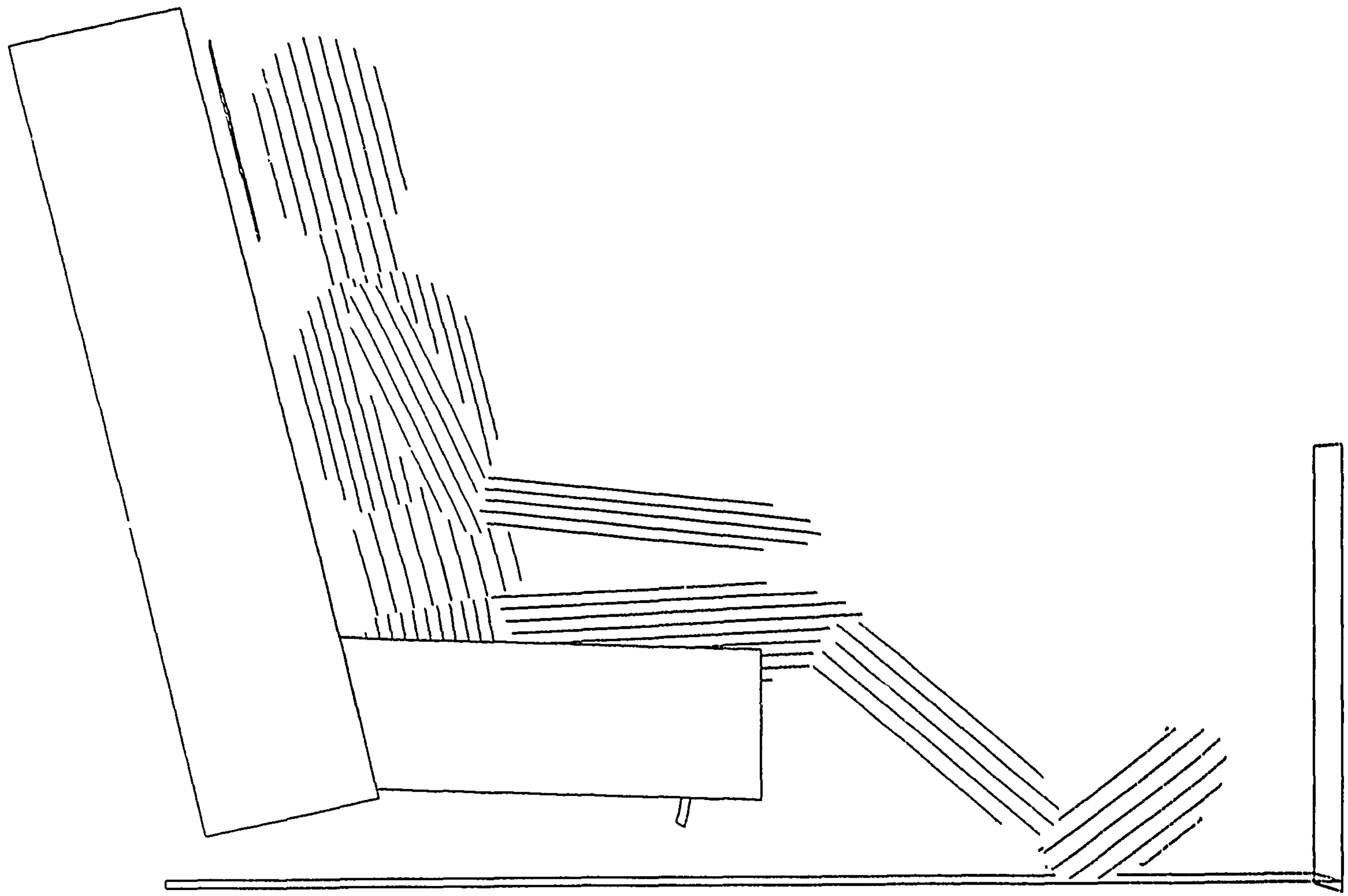
TIME (MSEC) 10



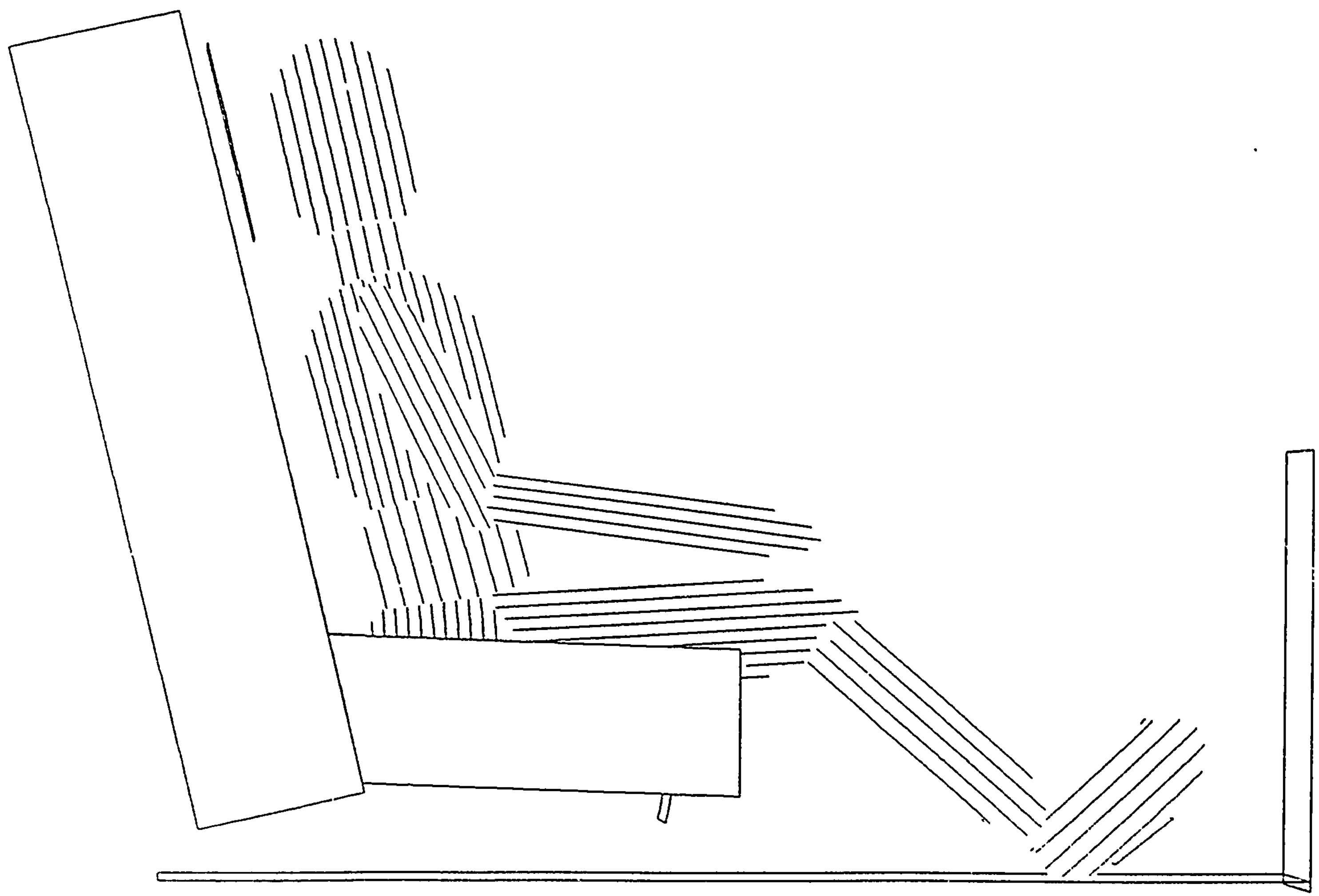
TIME (MSEC) 20



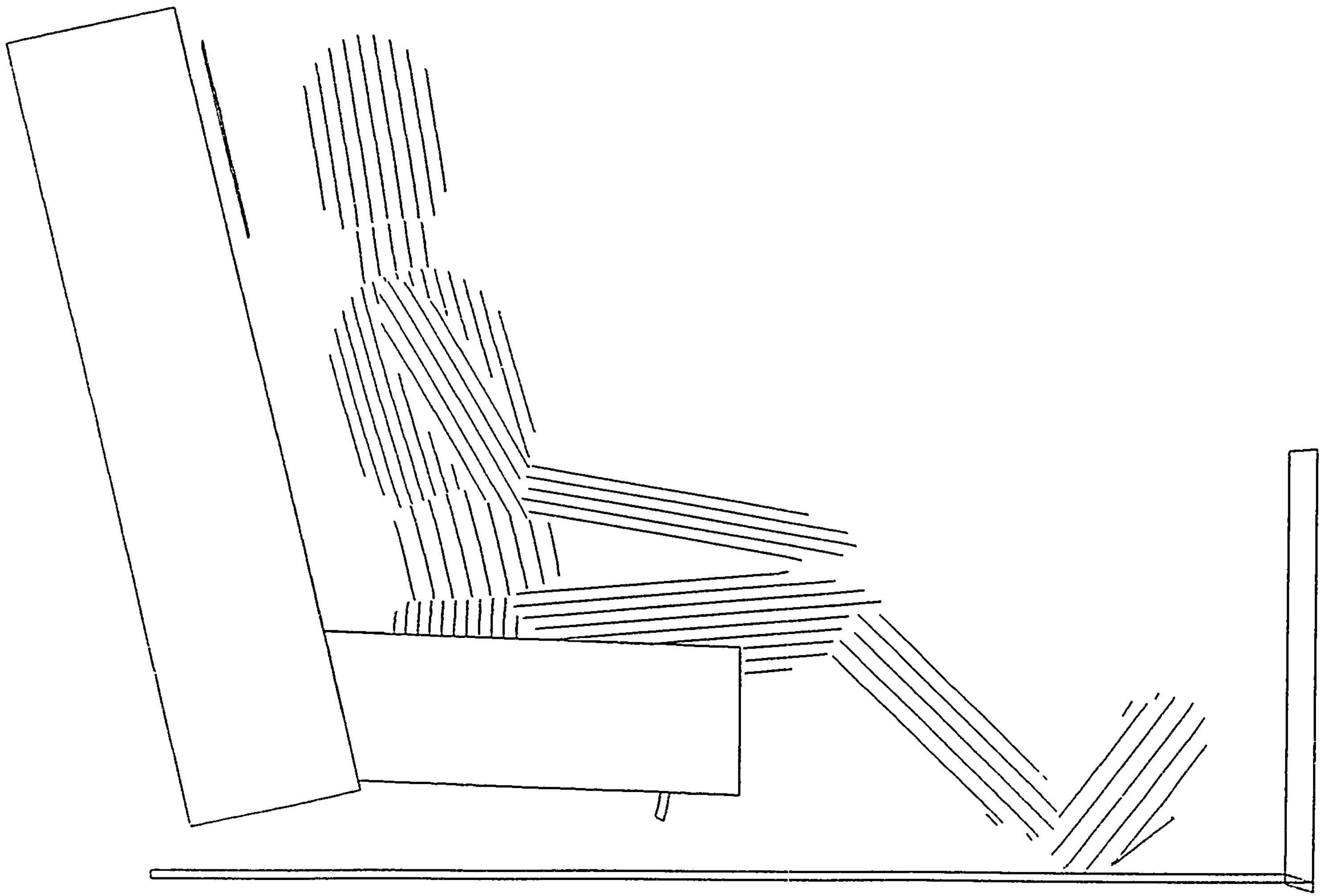
TIME (MSEC) 30



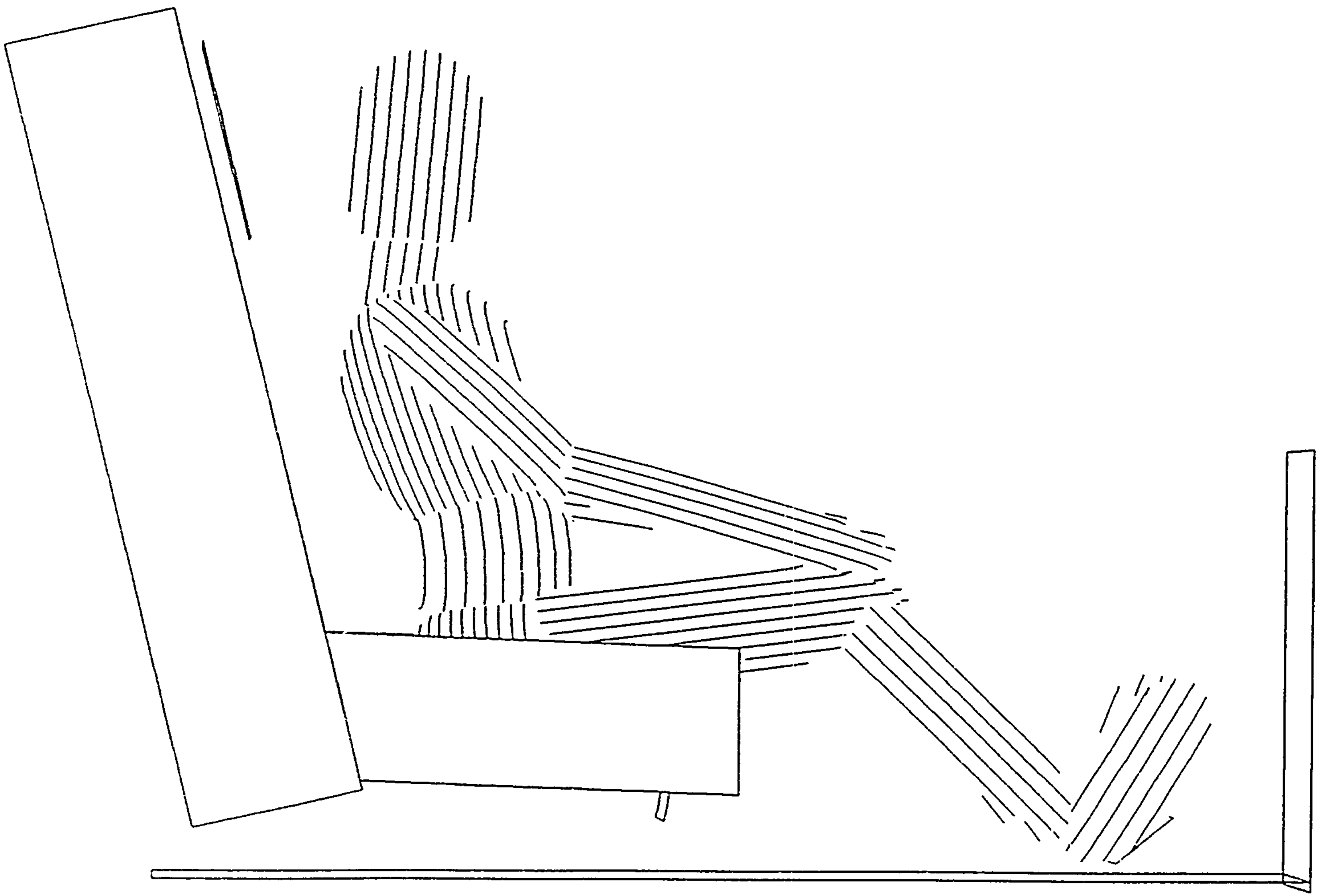
TIME (MSEC) 40



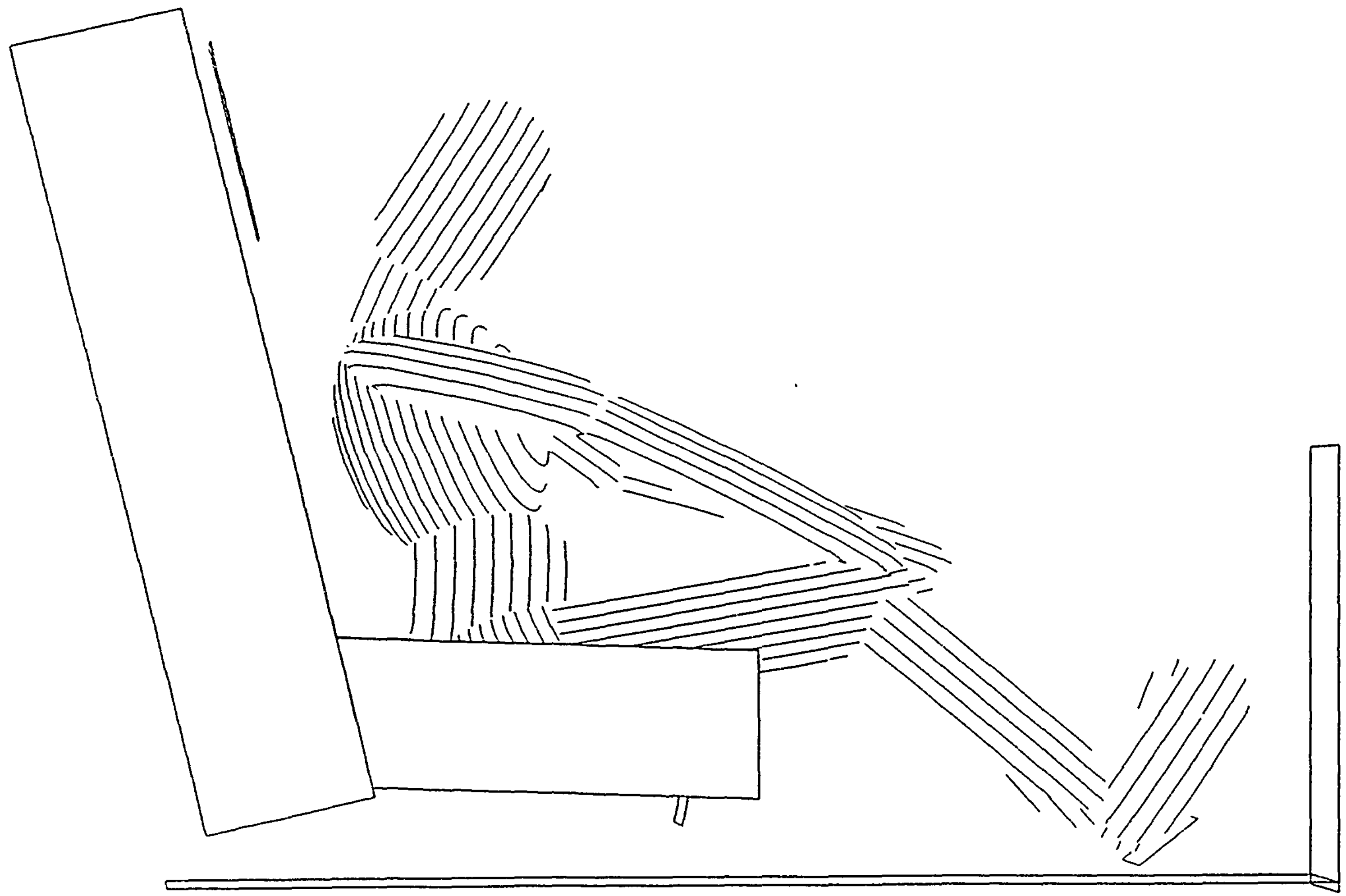
TIME (MSEC) 50



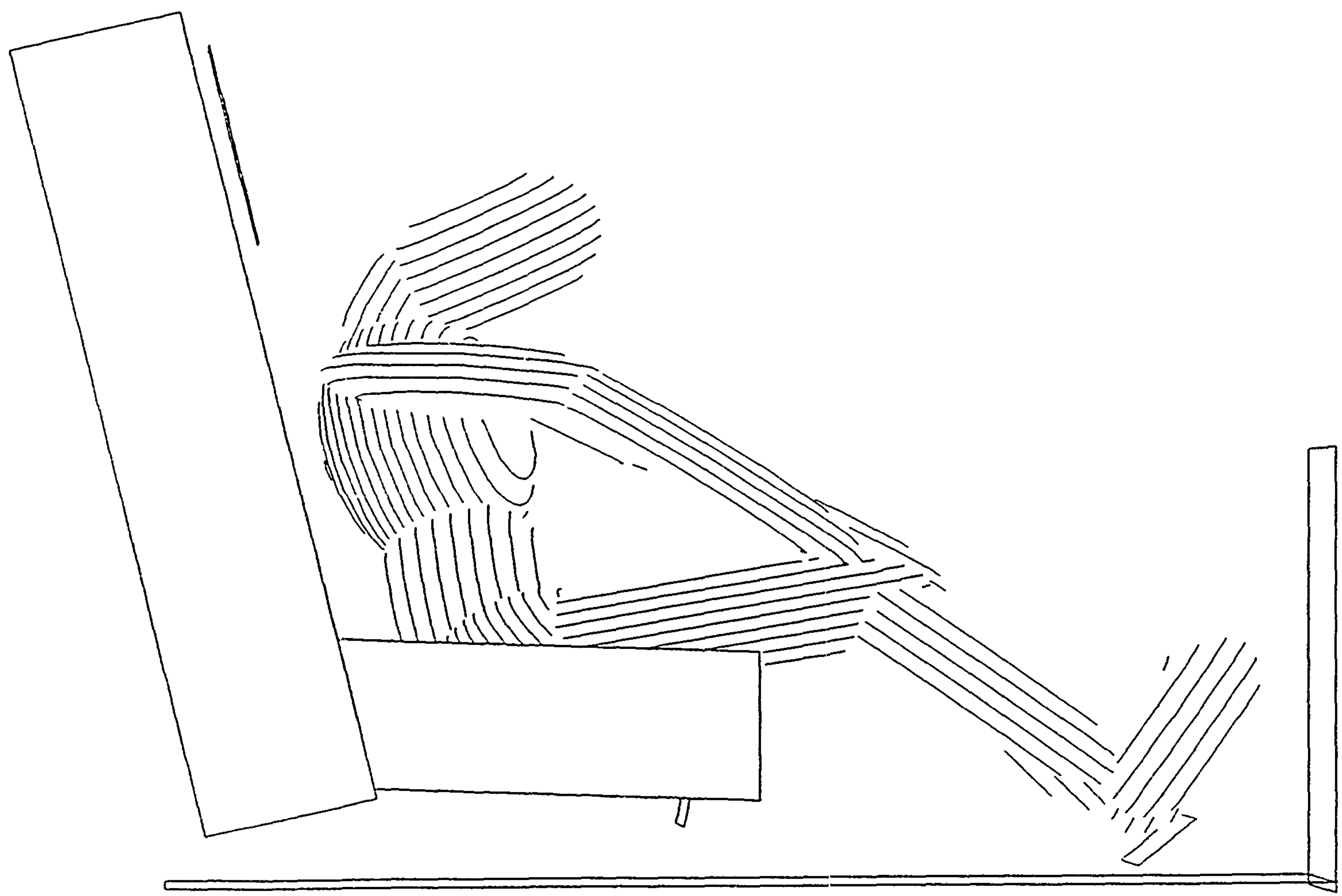
TIME (MSEC) 60



TIME (MSEC) 70



TIME (MSEC) 80



APPENDIX G1

Example 2, VIEW -- Input File (EXP2.VIW)

```
2
 1
                              4
                              4
                              4
                              4
   ATB COURSE EXAMPLE 2       4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4
                              4

0.000     0.010D0    .04D0
0000
 0 0 4

 0
         2         2         2         2         2         2         2         2
         2         2         2         2         2         2         2         2
         2         2         2         2         2         2         2         2
         2         2         2         2         2         2         1         1
         1         1         3         1         1         3         3         1
         1         3         3         1         1         1         1         1
         1         1         1         1         1         1         1         1
         1         1         1         1         1         1         1         1
         1         1         1         1         1         1         1         1
         1         1         1         1         1         1         1         1
         1         1         1         1         1         1         1         1
         1         1
         4
 8 5 8 3 5 5 3 3 5 3 3 3 3 3 31010
2020202020202020202020202020202020202020202020202020
  4        110.00
      4.0       4.0
      0.0    1000.0     -20.0       0.0       0.0     -20.0         4         2
     0.00      9.00
```

APPENDIX G2

Example 2, VIEW -- 386 Output Listing (EXP2.VOU)

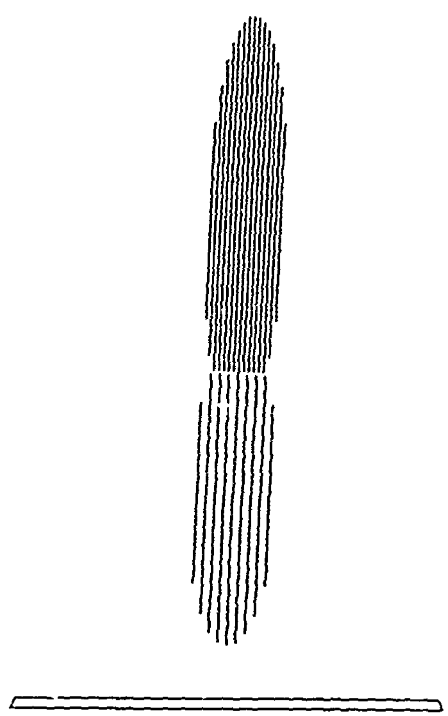
```
                                 4
                                 4
                                 4
                                 4
 ATB COURSE EXAMPLE 2            4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4
                                 4

000000000000000000000000000000000000000000000000000000000000000000000000000000000
0 0 4

 4          110.00
      4.        4.
MAIN - PROCESSING FRAME #   1
XMIN,XMAX=      0.000      9.000
MAIN - PROCESSI'.G FRAME #   2
MAIN - PROCESSING FRAME #   3
MAIN - PROCESSING FRAME #   4
MAIN - PROCESSING FRAME #   5
```

APPENDIX G3

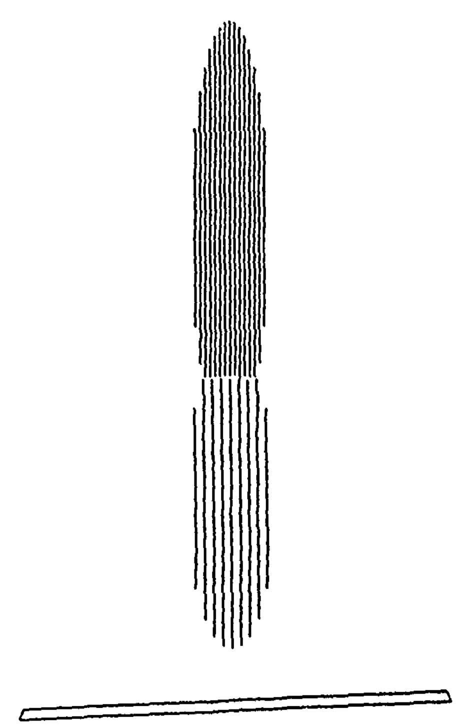
Example 2, VIEW -- 386 Output Graphics

ATB COURSE EXAMPLE 2

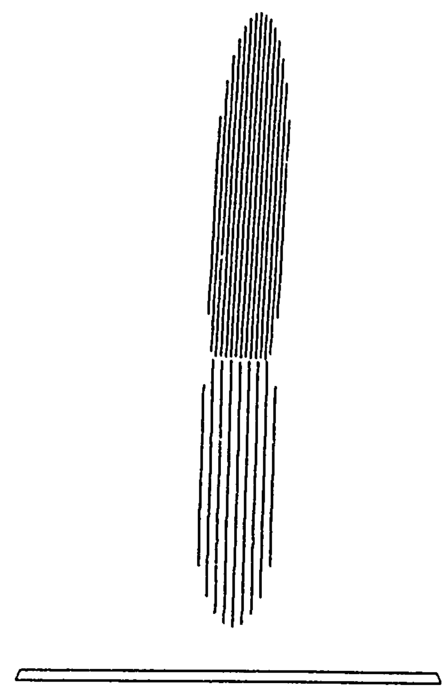
TIME (MSEC) 0



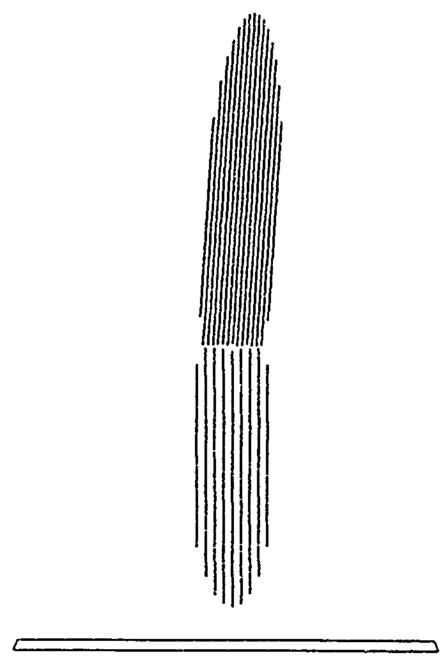
TIME (MSEC)   10



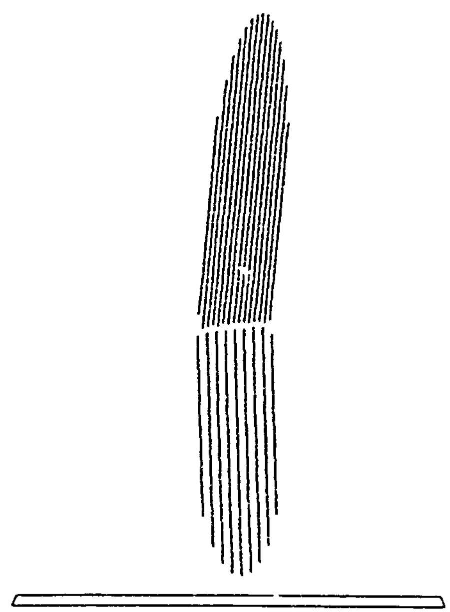
TIME (MSEC)   20



TIME (MSEC) 30



TIME (MSEC) 40



APPENDIX H

386-GEBOD Program Listing

```
C--PROGRAM GEBOD------(PERKIN-ELMER  FTN VII)--------------------------------C
C     GEBOD GENERATES BODY DESCRIPTION DATA SETS FOR USE IN THE ARTICULATED   C
C     TOTAL BODY (ATB) MODEL.  USER HAS CHOICE OF PRODUCING A DATA SET        C
C     CORRESPONDING TO ADULT MALE, ADULT FEMALE, CHILD SUBJECT, OR SOME       C
C     DUMMY SUBJECTS.  THE BASIC GEOMETRY OF THE MODEL USED TO CALCULATE THE  C
C     BODY DESCRIPTION DATA FOR THE HUMAN DATASETS IS AN EXTENSIVELY          C
C     MODIFIED VERSION OF THE MODEL USED BY CALSPAN CORP.  THE MODIFICATIONS  C
C     TO THE MODEL AND THE RESULTING PROGRAM, WERE WRITTEN BY THE             C
C     UNIVERSITY OF DAYTON RESEARCH INSTITUTE UNDER CONTRACT F33615-81-C-0513. C
C     THE MODIFICATIONS TO INCLUDE DUMMY DATASETS WERE WRITTEN BY BEECHER     C
C     RESEARCH COMPANY UNDER CONTRACT F33615-87-C-0530.                       C
C     80386 IMPLEMENTATION BY KETRON, INC., OCTOBER 31, 1989, UNDER CONTRACT  C
C     F33615-88-C-0543.                                                       C
C                                                                             C
C     FILES:                                                                  C
C        UNIT1--USER SUPPLIED DIMENSIONAL DATA.                               C
C        UNIT2--GEBOD.DAT DATA FILE FOR I/O.                                  C
C        UNIT3--RESULTS READY FOR INSERTION INTO AN ATB MODEL INPUT DECK.     C
C        UNIT5 (CRT OUTPUT)--INPUT PROMPTS ARE WRITTEN TO THIS UNIT.          C
C        UNIT7 (CRT INPUT)--SUBJECT DESCRIPTION IS ENTERED TO THIS UNIT.      C
C        UNIT9 (PRINTER)--TABLE FORM OF RESULTS.                              C
C                                                                             C
C     THE GEBOD.DAT FILE WHICH ACCOMPANIES THIS PROGRAM CONTAINS THE          C
C     FOLLOWING DATA:                                                         C
C        1. THE NUMBER OF SUBJECT TYPES IN LIST-DIRECTED FORMAT               C
C           AVAILABLE TO THE USER.                                            C
C        2. THE TITLES FOR THE SUBJECT TYPES IN LIST-DIRECTED FORMAT.         C
C        3. THE AAMRL/BBM ATB INPUT DATASETS THAT ARE AVAILABLE TO SPECIFIC   C
C           USERS AND USED AS INPUT TO THIS PROGRAM.  EACH ATB INPUT DATASET  C
C           IS PRECEEDED BY A HEADER IN LIST-DIRECTED FORMAT STATING THE      C
C           NUMBER OF RECORDS IN THE DATASET AND THE SUBJECT TYPE IT IS       C
C           ASSOCIATED WITH.  FOR EACH SUBJECT TYPE THERE ARE TWO DATASETS,   C
C           ONE IN ENGLISH UNITS AND THE OTHER IN METRIC UNITS.  NOTE         C
C           THAT NOT ALL SUBJECT TYPES HAVE DATA STORED IN THIS FILE AND      C
C           FOR SOME USERS THERE MAY NOT BE ANY ATB INPUT DATASETS STORED.    C
C                                                                             C
C     ROUTINES (IN ORDER OF APPEARANCE):                                      C
C        PROGRAM GEBOD                                                        C
C        BLOCK DATA                                                           C
C        SUBROUTINE DIALOG                                                    C
C        SUBROUTINE ASKUN                                                     C
C        SUBROUTINE PTILE                                                     C
C        SUBROUTINE CONTAC                                                    C
C        SUBROUTINE SEGMAS                                                    C
C        SUBROUTINE SGINER                                                    C
C        SUBROUTINE ELLIP                                                     C
C        ENTRY ELLPMI                                                         C
C        SUBROUTINE TORSO                                                     C
C        SUBROUTINE FEET                                                      C
C        SUBROUTINE RESULTS                                                   C
C        SUBROUTINE CNVRT                                                     C
C        SUBROUTINE RESULTZ                                                   C
```

```
C        SUBROUTINE ATBOUT                                                    C
C        SUBROUTINE NOATBOUT                                                  C
C---------------------------------------------------------------------------C

      PROGRAM GEBOD
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(0:2)
     &              ,RANGE(2,-1:1,3),CONV(-1:1)                        80386
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV                              80386
      CHARACTER*12 FILE2,FILE3,FILE9                                   80386

      PI = ACOS(-1.)
      PI2 = PI + PI
      PI4 = PI2 + PI2

      OPEN (UNIT=5,FILE='CON',CARRIAGE CONTROL='LIST')                 80386
      OPEN (UNIT=7,FILE='CON')                                         80386
      OPEN (UNIT=4,FILE='GEBODII.DIR',STATUS='OLD')                    80386
      READ (4,'(A12/A12/A12)')FILE2,FILE3,FILE9                        80386
      OPEN (UNIT=2,FILE=FILE2,STATUS='OLD')                            80386
      OPEN (UNIT=3,FILE=FILE3,STATUS='NEW')                            80386
      OPEN (UNIT=9,FILE=FILE9,STATUS='NEW',CARRIAGE CONTROL='FORTRAN') 80386
10    CALL DIALOG (IPTR,ICNT,ISTRT,ISUB)
      IF (ISUB.LE.4) THEN
         IF (IPTR.LT.25) THEN
            DO 100 I = ISTRT,31
               DD(I) = REGEQ(IPTR+ICNT,I)
               DO 100 J = 0,ICNT -1
100               DD(I) = DD(I) + PRED(J)*REGEQ(IPTR+J,I)
         ENDIF

         CALL CONTAC
         CALL SEGMAS
         CALL SGINER
         CALL RESULTS (ISTRT)
      ELSE
         CALL RESULTZ (ISUB)
      ENDIF
      REWIND (2)
      GOTO 10
      END
```

```
C--BLOCK DATA------------------------------------------------------------C
C     DATA IN COMMON AREAS                                               C
C     /SGMNTS/--SEGMENT DATA                                             C
C        ABCN--X,Y, AND Z CONTACT ELLIPSOID SEMIAXES FOR EACH SEGMENT    C
C        RMN--MASS OF EACH SEGMENT                                       C
C        PHI--SEGMENT MOMENTS OF INERTIA                                 C
C        XYZCG--LOCAL REFERENCE COORDINATES OF CENTER OF SEGMENT         C
C           CONTACT ELLIPSOIDS                                           C
C                                                                        C
C     /JNTS/--JOINT DATA                                                 C
C        RNJ--LOCAL REFERENCE SYSTEM COORDINATES OF EACH JOINT.  THIRD   C
C           SUBSCRIPT EQUAL TO 2 SPECIFIES LOCAL REFERENCE SYSTEM OF SEGMENT  C
C           J+1. A VALUE OF 1 IN THIS POSITION SPECIFIES LOCAL REFERENCE C
C           SYSTEM OF SEGMENT JNT(J), WHERE IN BOTH CASES J IS THE VALUE OF  C
C           THE FIRST SUBSCRIPT.                                         C
C        JNT--POINTER ARRAY FOR ASSOCIATING JOINTS WITH SEGMENTS         C
C        YPRLL--YAW, PITCH, AND ROLL ANGLES OF JOINT AXES RELATIVE TO LOCAL  C
C           REFERENCE AXES                                               C
C        IPIN--SPECIFIES JOINT TYPE                                      C
C                                                                        C
C     /DIMS/--BODY DIMENSION DATA                                        C
C        DD--BODY DIMENSIONS                                             C
C        REGEQ--REGRESSION EQUATIONS USED TO COMPUTE BODY DIMENSIONS     C
C        PRED--VALUES OF PREDICTING VARIABLES TO BE USED WITH REGEQ      C
C        RANGE--ACCEPTIBLE RANGE FOR PREDICTING VARIABLES                C
C        CONV--CONSTANTS FOR CONVERTING BODY DIMENSIONS FROM METRIC TO   C
C           ENGLISH UNITS                                                C
C                                                                        C
C     /NAMES/--CHARACTER STRINGS FOR VARIOUS LABLES                      C
C        SUBTYP--DESCRIPTION TO USER OF 4 SOURCES OF BODY DIMENSION DATA C
C        SEGLAB--SEGMENT LABLES                                          C
C        JNTLAB--JOINT LABLES                                            C
C        PLTSYM--PLOTTING SYMBOL FOR SEGMENTS AND JOINTS                 C
C        DIMLAB--NAMES OF THE BODY DIMENSIONS                            C
C        TITLE--RUN TITLE SUPPLIED BY THE USER                           C
C        UNITS--UNITS FOR USER TO CHOOSE BETWEEN                         C
C                                                                        C
C     /FLOAT/--VARIOUS CONSTANTS                                         C
C        PI--THE CONSTANT PI                                             C
C        PI2--PI**2                                                      C
C        PI4--PI**4                                                      C
C        DENS--DENSITY USED FOR COMPUTATION OF SEGMENT INERTIAL PROPERTIES  C
C        GRAV--ACCELERATION OF GRAVITY                                   C
C                                                                        C
C     /CYL/--DATA USED IN RIGHT ELLIPTICAL CYLINDER MODELLING OF SEGMENTS   C
C        FOR COMPUTATION OF INERTIAL PROPERTIES                          C
C        ZEES--CONTAINS Z CORDINATE GIVING VERTICAL EXTENT OF CYLINDERS  C
C        ZH--HEIGHT OF EACH CYLINDER IN THE NUMERICAL INTEGRATION        C
C        NSEG--NUMBER OF CYLINDERS IN THE NUMERICAL INTEGRATION          C
C        CGZ--Z COORDINATE OF CENTER OF GRAVITY OF MODEL                 C
C        WTCOR--EIGHT COORECTION FACTOR USED TO ADJUST DENS              C
C                                                                        C
```

```
C     ALL DATA WILL BE CALCULATED AND STORED IN ENGLISH UNITS               C
C        DD(-1)--MONTHS                                                     C
C        DD(0)--POUNDS                                                      C
C        DD(1)-DD(31)--INCHES                                               C
C        DENS--SLUG/IN**3                                                   C
C        GRAV--FT/SEC**2                                                    C
C        RMN--SLUGS                                                         C
C        PHI--SLUG*IN**2                                                    C
C        ALL REMAINING LINEAR MEASUREMENTS ARE IN INCHES                    C
C     THESE UNITS ARE UTILIZED UNTIL JUST PRIOR TO WRITTING OUT OF RE-      C
C     SULTS.  VALUES ARE THEN CONVERTED, IN PLACE, TO APPROPRIATE UNITS.    C
C     THE VALUE STORED IN GRAV IS USED FOR CONVERSION FROM SLUGS TO         C
C     POUNDS.                                                               C
C---------------------------------------------------------------------------C

      BLOCK DATA
      COMMON /SGMNTS/ ABCN(15,3),RMN(15),PHI(3,15),XYZCG(15,3)
      COMMON /JNTS/ RNJ(3,28),JNT(14),YPRLL(14,6),IPIN(14)
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(3),
     &              RANGE(2,-1:1,3),CONV(-1:1)
      COMMON /NAMES/ SUBTYP(10),SEGLAB(15),JNTLAB(14),PLTSYM(29),
     &               DIMLAB(-1:31),TITLE,UNITS(3,-1:2)
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV
      COMMON /CYL/ ZEES(0:15),ZH(15),NSEG(15),CGZ(15),WTCOR
      CHARACTER SUBTYP*35,SEGLAB*3,JNTLAB*2,PLTSYM*1,DIMLAB*24,TITLE*60 80386
      CHARACTER UNITS*6

      DATA SEGLAB/'LT ','CT ','UT ','N  ','H  ','RUL','RLL',
     &'RF ','LUL','LLL','LF ','RUA','RLA','LUA','LLA'/
      DATA JNTLAB/'P ','W ','NP','HP','RH','RK','RA',
     &'LH','LK','LA','RS','RE','LS','LE '/
      DATA PLTSYM/'1' '2','3','4','5','6','7','8','9','A','B','C','D',
     &'E','F','M','N','O','P','Q','R','S','T','U','V','W','X','Y','Z'/
      DATA JNT/1,2,3,4,1,6,7,1,9,10,3,12,3,14/
      DATA UNITS /'MONTHS','YEARS',' ','LB.','N.','%-TILE',
     &            'IN.','M.','%-TILE','ENGLSH','METRIC',' '/
      DATA CONV /12.,.2248,39.370/,DENS,GRAV/1.12287E-3,32.17405/
C
C DIMENSIONAL DATA LABELS
      DATA DIMLAB /
     &     'AGE                     ','WEIGHT                  ',
     &     'STANDING HEIGHT         ','SHOULDER HEIGHT         ',
     &     'ARMPIT HEIGHT           ','WAIST HEIGHT            ',
     &     'SEATED HEIGHT           ','HEAD LENGTH             ',
     &     'HEAD BREADTH            ','HEAD TO CHIN HEIGHT     ',
     &     'NECK CIRCUMFERENCE      ','SHOULDER BREADTH        ',
     &     'CHEST DEPTH             ','CHEST BREADTH           ',
     &     'WAIST DEPTH             ','WAIST BREADTH           ',
     &     'BUTTOCK DEPTH           ','HIP BREADTH,STANDING    ',
     &     'SHOULDER TO ELBOW LENGTH','FOREARM-HAND LENGTH     ',
     &     'BICEPS CIRCUMFERENCE    ','ELBOW CIRCUMFERENCE     ',
     &     'FOREARM CIRCUMFERENCE   ','WRIST CIRCUMFERENCE     ',
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&     'KNEE HEIGHT,SEATED       ','THIGH CIRCUMFERENCE      ',
&     'UPPER LEG CIRCUMFERENCE ','KNEE CIRCUMFERENCE       ',
&     'CALF CIRCUMFERENCE       ','ANKLE CIRCUMFERENCE      ',
&     'ANKLE HEIGHT,OUTSIDE     ','FOOT BREADTH             ',
&     'FOOT LENGTH              '/
 DATA RANGE /
& 24.00     , 240.0     , 22.27     , 247.6     , 32.01     , 76.54     ,
& 18.50     , 56.50     , 85.00     , 200.0     , 56.93     , 72.05     ,
& 21.50     , 50.50     , 118.0     , 264.0     , 62.17     , 77.64     /
 DATA (REGEQ(J,-1), J=1,24) /
& 1.000     , .4547E-12, 1.213     , 25.43     , 5.202     ,-158.9     ,
& 1.000     ,0.        ,0.        , .4547E-12,0.         ,0.         ,
&0.         ,0.        ,0.        ,0.        ,0.         ,0.         ,
&0.         ,0.        ,0.        ,0.        ,0.         ,0.         /
 DATA (REGEQ(J, 0), J=1,24) /
& .6625     ,-.7660    , 1.000     , .4547E-12, 3.743     ,-122.2     ,
&0.         , 1.000    ,0.         , .4547E-12, 1.000     , .4547E-12,
& 3.737     ,-111.2    , 1.000     ,0.        , .4547E-12, 1.000     ,
& .9095E-12, 4.530     ,-142.7     , 1.000     ,0.        , .9095E-12/
 DATA (REGEQ(J, 1), J=1,24) /
& .1756     , 32.62     , .2314     , 35.58     , 1.000     , .2274E-12,
&0.         ,0.         , 1.000     , .2274E-12, .7589E-01, 54.16     ,
& 1.000     , .2274E-12,0.          , 1.000     , .2274E-12, .5850E-01,
& 59.66     , 1.000     , .454[illegible]2,0.    , 1.000     , .4547E-12/
 DATA (REGEQ(J, 2), J=1,24) /
& .1518     , 24.79     , .1994     , 27.37     , .8721     ,-3.898     ,
&0.         ,0.         , .8721     ,-3.898     , .7182E-01, 42.77     ,
& .8751     ,-3.936     , .7555E-02, .8469     ,-3.096     , .5844E-01,
& 47.02     , .8911     ,-5.049     , .8583E-02, .8522     ,-3.824     /
 DATA (REGEQ(J, 3), J=1,24) /
& .1467     , 22.53     , .1916     , 25.19     , .8315     ,-4.469     ,
&0.         ,-.1217E-01, .8770     ,-5.954     , .5840E-01, 39.83     ,
& .8309     ,-5.762     ,-.6495E-02, .8551     ,-6.484     , .4637E-01,
& 43.06     , .8398     ,-7.529     ,-.3761E-02, .8569     ,-8.066     /
 DATA (REGEQ(J, 4), J=1,24) /
& .1186     , 17.74     , .1530     , 19.97     , .6822     ,-4.726     ,
&0.         ,-.1855E-01, .7519     ,-7.012     , .5302E-01, 32.73     ,
& .6845     ,-4.206     ,0.         , .6845     ,-4.206     , .3642E-01,
& 35.59     , .7043     ,-7.256     ,-.6506E-02, .7338     ,-8.185     /
 DATA (REGEQ(J, 5), J=1,24) /
& .7804E-01, 19.17     , .1047     , 20.34     , .4412     , 4.849     ,
& .5848E-02, .1910E-01, .3393     , 8.114     , .3620E-01, 29.09     ,
& .4225     , 6.734     , .5773E-02, .4010     , 7.376     , .2664E-01,
& 32.06     , .4043     , 8.460     , .4060E-02, .3859     , 9.039     /
 DATA (REGEQ(J, 6), J=1,24) /
& .3642E-02, 6.881     , .5571E-02, 6.881     , .2249E-01, 6.110     ,
&-.3975E-02, .2793E-02, .3264E-01, 5.825     , .4897E-02, 6.625     ,
& .3600E-01, 4.950     , .3021E-02, .2471E-01, 5.286     , .3209E-02,
& 7.266     , .2680E-01, 5.952     , .2233E-02, .1668E-01, 6.271     /
 DATA (REGEQ(J, 7), J=1,24) /
& .3642E-02, 5.220     , .5337E-02, 5.237     , .2096E-01, 4.532     ,
&-.6471E-03, .3641E-02, .1071E-01, 4.873     , .4089E-02, 5.194     ,
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& .1347E-01, 4.855    , .4089E-02,0.        , 5.194    , .3060E-02,
& 5.611    , .1174E-01, 5.322    , .3060E-02,0.        , 5.611    /
 DATA (REGEQ(J, 8), J=1,24) /
& .8988E-02, 6.582    , .1266E-01, 6.666    , .5203E-01, 4.867    ,
&-.2157E-02, .4550E-02, .4621E-01, 5.080    , .7362E-02, 7.688    ,
& .6816E-01, 4.275    , .3057E-02, .5674E-01, 4.615    , .3143E-02,
& 8.420    , .4659E-01, 5.712    ,0.        , .4659E-01, 5.712    /
 DATA (REGEQ(J, 9), J=1,24) /
& .2281E-01, 8.421    , .3449E-01, 8.448    , .1301    , 4.177    ,
&-.2812E-02, .3292E-01, .2141E-01, 7.760    , .2316E-01, 10.34    ,
& .8900E-01, 7.607    , .2316E-01,0.        , 10.34    , .2444E-01,
& 10.85    , .6527E-01, 10.54    , .2806E-01,-.6185E-01, 14.54    /
 DATA (REGEQ(J,10), J=1,24) /
& .3595E-01, 7.530    , .4866E-01, 8.020    , .2040    , .8749    ,
& .4037E-02, .1483E-01, .1271    , 3.354    , .1927E-01, 11.66    ,
& .1246    , 6.160    , .1369E-01, .7344E-01, 7.682    , .1612E-01,
& 13.24    , .1181    , 7.790    , .1253E-01, .6133E-01, 9.578    /
 DATA (REGEQ(J,11), J=1,24) /
& .2870E-01, 5.225    , .4249E-01, 5.333    , .1620    ,-.2418E-01,
&0.        , .3764E-01, .2091E-01, 4.589    , .3412E-01, 4.965    ,
& .7300E-01, 4.650    , .3989E-01,-.7607E-01, 9.086    , .2690E-01,
& 4.984    , .6114E-01, 5.386    , .3174E-01,-.8265E-01, 9.915    /
 DATA (REGEQ(J,12), J=1,24) /
& .2699E-01, 5.195    , .3856E-01, 5.411    , .1504    , .3666    ,
& .4513E-02, .2798E-01, .2213E-01, 4.506    , .3185E-01, 6.968    ,
& .8875E-01, 5.357    , .3505E-01,-.4222E-01, 9.255    , .2911E-01,
& 7.854    , .8877E-01, 6.709    , .3254E-01,-.5866E-01, 11.35    /
 DATA (REGEQ(J,13), J=1,24) /
& .1284E-01, 5.024    , .2279E-01, 4.763    , .7598E-01, 2.485    ,
&-.8176E-02, .3995E-01,-.3147E-01, 6.097    , .2922E-01, 2.979    ,
& .5358E-01, 3.279    , .3511E-01,-.7761E-01, 7.183    , .3026E-01,
& 3.528    , .5167E-01, 5.174    , .3706E-01,-.1162    , 10.46    /
 DATA (REGEQ(J,14), J=1,24) /
& .2718E-01, 5.367    , .3977E-01, 5.508    , .1522    , .4650    ,
& .3925E-02, .3503E-01,0.        , 5.406    , .3527E-01, 5.010    ,
& .1060    , 2.734    , .3800E-01,-.3598E-01, 6.959    , .3741E-01,
& 5.694    , .1105    , 4.473    , .4211E-01,-.8025E-01, 10.48    /
 DATA (REGEQ(J,15), J=1,24) /
& .2730E-01, 4.812    , .4032E-01, 4.910    , .1528    ,-.1220    ,
& .4893E-02, .3874E-01,-.1900E-01, 5.466    , .3419E-01, 3.976    ,
& .7090E-01, 3.803    , .4021E-01,-.7937E-01, 8 275    , .3077E-01,
& 4.095    , .6978E-01, 4.566    , .3632E-01,-.9475E-01, 9.749    /
 DATA (REGEQ(J,16), J=1,24) /
& .3552E-01, 5.542    , .4957E-01, 5.905    , .1968    ,-.7718    ,
& .1151E-01, .3192E-01, .1642E-01, 5.020    , .4052E-01, 8.610    ,
& .1285    , 5.563    , .4294E-01,-.3192E-01, 10.34    , .2803E-01,
& 9.019    , .1258    , 5.100    , .2803E-01,0.        , 9.019    /
 DATA (REGEQ(J,17), J=1,24) /
& .3933E-01, 6.369    , .5175E-01, 7.038    , .2237    ,-.9239    ,
& .8433E-03,0.        , .2193    ,-.7898    , .1702E-01, 10.04    ,
& .1962    ,-.3163    , .2976E-02, .1851    , 1459E-01, .1256E-01,
& 11.97    , .2087    ,-.4158    ,0.        , .2087    ,-.4158    /
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      DATA (RECEQ(J,18), J-1,24) /
     & .4900E-01, 8.421    , .6536E-01, 9.182    , .2804    ,-.7587    ,
     &-.2689E-02, .4490E-02, .2776    ,-.6374    , .2092E-01, 13.78    ,
     & .2478    , .6324    , .2960E-02, .2367    , .9615    , .1671E-01,
     & 16.54    , .2646    , .9735    , .1677E-02, .2570    , 1.213    /
      DATA (REGEQ(J,19), J-1,24) /
     & .2664E-01, 4.976    , .4173E-01, 4.878    , .1501    , .1143    ,
     &0.        , .5211E-01,-.4492E-01, 6.478    , .4369E-01, 4.522    ,
     & .5386E-01, 6.646    , .5528E-01,-.1527    , 12.79    , .3340E-01,
     & 6.608    , .5996E-01, 8.219    , .4067E-01,-.1243    , 14.02    /
      DATA (REGEQ(J,20), J=1,24) /
     & .2267E-01, 5.152    , .3434E-01, 5.166    , .1290    , .9440    ,
     &-.1938E-02, .3358E-01, .1344E-01, 4.738    , .2421E-01, 7.539    ,
     & .1221    , 2.826    , .2086E-01, .4420E-01, 5.145    , .1919E-01,
     & 8.967    , .1061    , 4.894    , .1767E-01, .2601E-01, 7.416    /
      DATA (REGEQ(J,21), J-1,24) /
     & .2267E-01, 5.152    , .3434E-01, 5.166    , .1290    , .9440    ,
     &-.1938E-02, .3358E-01, .1344E-01, 4.738    , .2643E-01, 5.879    ,
     & .7088E-01, 4.719    , .2938E-01,-.3890E-01, 7.986    , .2116E-01,
     & 7.411    , .6768E-01, 6.359    , .2341E-01,-.3835E-01, 9.700    /
      DATA (REGEQ(J,22), J-1,24) /
     & .1145E-01, 3.971    , .1771E-01, 3.951    , 6620E-01, 1.791    ,
     &-.3478E-02, .1804E-01, .1674E-01, 3.447    , .1090E-01, 4.503    ,
     & .5371E-01, 2.463    , .9530E-02, .1810E-01, 3.523    , .9921E-02,
     & 5.202    , .5166E-01, 3.317    , .9386E-02, .9137E-02, 4.657    /
      DATA (REGEQ(J,23), J-1,24) /
     & .5917E-01, 9.584    , .7857E-01, 10.55    , .3433    ,-1.746    ,
     &-.8480E-02,-.4527E-02, .4045    ,-3.654    , .3002E-01, 14.98    ,
     & .3345    ,-2.547    , .6469E-02, .3104    ,-1.828    , .2467E-01,
     & 17.67    , .3558    ,-2.889    , .5244E-02, .3321    ,-2.141    /
      DATA (REGEQ(J,24), J-1,24) /
     & .6066E-01, 9.311    , .8944E-01, 9 551    , .3382    ,-1.560    ,
     & .1018E-01, .8338E-01,-.2709E-01, 10.25    , .8417E-01, 11.13    ,
     & .1869    , 9.912    , .9769E-01,-.1781    , 20.77    , .6998E-01,
     & 11.01    , .1614    , 11.89    , .8237E-01,-.2117    , 23.64    /
      DATA (REGEQ(J,25), J-1,24) /
     & .4805E-01, 7.998    , .7076E-01, 8.195    , .2691    ,-.6787    ,
     & .5930E-02, .6358E-01,0.        , 8.043    , .6412E-01, 9.905    ,
     & .1664    , 7.448    , .7187E-01,-.1022    , 15.44    , .3229E-01,
     & 9.621    , .1412    , 5.370    , .3229E-01,0.        , 9.621    /
      DATA (REGEQ(J,26), J-1,24) /
     & .4805E-01, 7.998    , .7076E-01, 8.195    , .2691    ,-.6787    ,
     & .5930E-02, .6358E-01,0.        , 8.043    , .4406E-01, 8.684    ,
     & .1458    , 4.985    , .4605E-01,-.2626E-01, 10.11    , .3334E-01,
     & 9.686    , .1512    , 4.918    , .3334E-01,0.        , 9.686    /
      DATA (REGEQ(J,27), J-1,24) /
     & .3544E-01, 6.685    , .5209E-01, 6.839    , .1998    , .2129    ,
     & .1539E-02, .4370E-01, .2825E-01, 5.794    , .4012E-01, 8.335    ,
     & .1106    , 6.386    , .4429E-01,-.5493E-01, 11.31    , .3250E-01,
     & 9.002    , .8842E-01, 8.469    , .3718E-01,-.3000E-01, 13.77    /
      DATA (REGEQ(J,28), J-1,24) /
     & .1770E-01, 5.116    , .2659E-01, 5.152    , .1016    , 1.786    ,
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      &-.3664E-02, .2284E-01, .3523E-01, 3.995    , .1809E-01, 5.999    ,
      & .7603E-01, 3.449    , .1720E-01, .1177E-01, 5.361    , .1610E-01,
      & 6.028    , .6599E-01, 4.216    , .1665E-01,-.9456E-02, 6.593    /
       DATA (REGEQ(J,29), J=1,24) /
      & .6837E-02, 1.319    , .9232E-02, 1.417    , .4015E-01,-.2052E-01,
      &-.1302E-02,0.        , .4697E-01,-.2305    , .3434E-02, 2.230    ,
      & .4163E-01, .9788E-02,0.        , .4163E-01, .9788E-02, .4310E-02,
      & 4.652    , .8736E-01,-.6990    ,-.1090E-02, .9230E-01,-.8545    /
       DATA (REGEQ(J,30), J=1,24) /
      & .8742E-02, 2.193    , .1221E-01, 2.283    , .5052E-01, .5281    ,
      &-.1722E-02, .4119E-02, .4407E-01, .7576    , .4638E-02, 2.901    ,
      & .2947E-01, 1.611    , .3353E-02, .1694E-01, 1.984    , .4136E-02,
      & 3.127    , .3418E-01, 1.459    , .2907E-02, .2101E-01, 1.873    /
       DATA (REGEQ(J,31), J=1,24) /
      & .2436E-01, 5.384    , .3275E-01, 5.742    , .1416    , .7017    ,
      &-.5757E-02,0.        , .1715    ,-.2125    , .1365E-01, 7.738    ,
      & .1299    , 1.186    , .5296E-02, .1101    , 1.775    , .1028E-01,
      & 8.858    , .1309    , 1.502    , .3570E-02, .1148    , 2.012    /
C
C YAW,PITCH AND ROLL
       DATA YPRLL/
      &   46*0.,8.1,0.,-8.1,-8.1,0.,8.1,28.8,80.,-28.8,-80.,0.,0.,20.,    REV1/87
      &   0.,-44.4,65.6,-80.,-44.4,65.6,-80.,-39.6,-70.,-39.6,-70.,       REV1/87
      &   4*0.,14.5,-3.3,0.,-14.5,3.3,0.,63.3,0.,-63.3,0./                REV1/87
       DATA IPIN/0,0,0,0,0,1,0,0,1,0,0,1,0,1/
       END
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C--SUBROUTINE DIALOG---------------------------------------------------------C
C     DIALOG WRITES PROMPTS TO THE CRT AND ACCEPTS INPUT FROM THE CRT        C
C     DESCRIBING THE SUBJECT FOR WHICH BODY DESCRIPTION DATA IS TO BE        C
C     PRODUCED.  THE PARAMETERS, IPTR, ICNT, AND ISTRT, ARE RETURNED TO THE  C
C     MAIN ROUTINE SPECIFYING THE CHOICES MADE BY THE USER                   C
C        IPTR--SPECIFIES ROW OF REGEQ CONTAINING FIRST REGRESSION EQUATION   C
C           COEFFICIENT TO BE USED.  IPTR IS SET TO 25 FOR USER SUPPLIED     C
C           DIMENSIONAL DATA.                                                C
C        ICNT--NUMBER OF COEFFICIENTS IN THE REGRESSION EQUATION TO BE USED. C
C        ISTRT--FIRST BODY DIMENSION TO BE GENERATED:                        C
C           ISTRT =-1 (AGE) FOR CHILD SUBJECTS                               C
C           ISTRT =0 (WEIGHT) FOR ADULT SUBJECTS OR USER SUPPLIED DATA       C
C     VALUES ARE ALSO READ INTO PRED FOR THE PREDICTING VARIABLES            C
C----------------------------------------------------------------------------C

      SUBROUTINE DIALOG (IPTR,ICNT,ISTRT,ISUB)
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(-1:1),
     &              RANGE(2,-1:1,3),CONV(-1:1)
      COMMON /NAMES/ SUBTYP(10),SEGLAB(15),JNTLAB(14),PLTSYM(29),
     &               DIMNM(-1:31),TITLE,UNITS(3,-1:2)
      CHARACTER SUBTYP*35,SEGLAB*3,JNTLAB*2,PLTSYM*1,ANS*1,DIMNM*24
      CHARACTER TITLE*60,UNITS*6
      CHARACTER*12 FILE1                                            80386
      INTEGER IPTMAT(-1:2,3),IPT2(13)
      EQUIVALENCE (IPTMAT,IPT2)
      DATA IPT2 /1,3,5,7,11,11,13,15,18,18,20,22,25/

      WRITE (5,22)
      READ (7,333) TITLE
      WRITE (5,333) ' '//TITLE
      WRITE (9,333) '1'//TITLE

      READ (2,*) NUMTYP
      READ (2,*) (SUBTYP(I),I=1,NUMTYP)
10    WRITE (5,33) (I,SUBTYP(I),I=1,NUMTYP)
      WRITE (5,44)
      READ (7,222) ISUB
      IF (ISUB.GT.NUMTYP .OR. ISUB.LT.1)  GOTO 10
      WRITE (9,333) '0'//SUBTYP(ISUB)
      ISTRT = -1
      IF (ISUB.GT.1)  ISTRT = 0
      IF (ISUB.EQ.4)  GOTO 100
      IF (ISUB.GT.4) THEN
         IPTR = 0
         ICNT = 0
         ISTRT = 0
         RETURN
      ENDIF

20    WRITE (5,33) (I+1,DIMNM(I),I=ISTRT,1),3,'ALL OF THE ABOVE'
      WRITE (5,55)
      READ (7,222) IDIM
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```
      IDIM = IDIM -1
      IF (IDIM.LT.ISTRT .OR. IDIM.GT.2)  GOTO 20
      IF (IDIM.GE.2)  THEN
         LPSTRT = ISTRT
         LPEND = 1
      ELSE
         LPSTRT = IDIM
         LPEND = LPSTRT
      ENDIF

      WRITE (9,555)
      DO 50 I = LPSTRT,LPEND
         CALL ASKUN (DIMNM(I),UNITS(1,I),ICHOS,ISTRT+3)
         IF (ICHOS.GE.3) THEN
            CALL PTILE (ISUB,I,PRED(I))
         ELSE
            TCONV = 1.
            IF (ICHOS.GE.2)  TCONV = CONV(I)
40          WRITE (5,77) DIMNM(I),(RANGE(J,I,ISUB)/TCONV,J=1,2)
            READ (5,444)  PRED(I)
            WRITE (9,666) DIMNM(I),PRED(I),UNITS(ICHOS,I)
            PRED(I) = PRED(I)*TCONV
            IF ((PRED(I)-RANGE(1,I,ISUB))*(PRED(I)-RANGE(2,I,ISUB))
     &           .GT. 0.)   GOTO 40
         ENDIF
50       CONTINUE

      IF (IDIM.LT.2)  THEN
         PRED(-1) = PRED(IDIM)
      ELSE
         IF (ISUB.GT.1)  THEN
            DO 60 I=-1,0
60             PRED(I) = PRED(I+1)
         ENDIF
      ENDIF
      IPTR = IPTMAT(IDIM,ISUB)
      ICNT = IPTMAT(IDIM+1,ISUB) - IPTR - 1
      RETURN

100   WRITE (5,88)
      READ (7,333) ANS
      IF (ANS.EQ.'N'.OR.ANS.EQ.'n')  STOP 'FROM DIALOG'                80386
      IF (ANS.NE.'Y'.AND.ANS.NE.'y')  GOTO 100                         80386
      CLOSE (UNIT=4)                                                   80386
      OPEN (UNIT=4,FILE='GEBODII.DIR',STATUS='OLD')                    80386
      READ (4,'(///A12)')FILE1                                         80386
      OPEN (UNIT=1,FILE=FILE1,STATUS='OLD')                            80386
      READ (1,99) (DD(I),I=0,31)
      CLOSE (UNIT=1)                                                   80386
      IPTR = 25
      CALL ASKUN(SUBTYP(4),UNITS(1,2),ICHOS,2)
      IF (ICHOS.GE.2)  THEN
```

```
          DD(0) = DD(0)*CONV(0)
          DO 120 I=1,31
120          DD(I) = DD(I)*CONV(1)
       ENDIF
       RETURN

22     FORMAT (//' PROGRAM GEBOD'/' GEBOD GENERATES BODY DESCRIPTION',
     &          ' DATA'/' SUITABLE FOR INPUT TO THE ATB MODEL'/
     &          ' PLEASE ENTER A DESCRIPTION OF THE SUBJECT' ,
     &          ' (<60 CHARS.)')
33     FORMAT (//(I12,')',3X,A/))
44     FORMAT (' ENTER NUMBER CORRESPONDING TO DESIRED SUBJECT TYPE')
55     FORMAT (' ENTER NUMBER CORRESPONDING TO '/' PREDICTING',
     &          ' DIMENSION(S) TO BE SUPPLIED')
77     FORMAT (' ENTER VALUE FOR ',A24/' IN THE RANGE ',G10.4,',',G10.4)
88     FORMAT (//' TO UTILIZE EXTERNAL DIMENSIONAL DATA, THE DATA MUST',
     &  ' BE'/' IN THE PROPER FORMAT AND IN A FILE ASSIGNED TO UNIT 1'/
     &          ' HAS THE ABOVE BEEN SATISFIED (Y/N) ?')
99     FORMAT (8F10.0)
222    FORMAT (BN,I60)
333    FORMAT (A)
444    FORMAT (G60.0)
555    FORMAT ('OSELECTED BODY DIMENSIONS'/)
666    FORMAT (A40,G15.4,A6)
       END
```

```
C--SUBROUTINE ASKUN-----------------------------------------------------------C
C     ASKUN ASKS USER CHOICE OF UNITS TO BE USED WITH SOME INPUT VARIABLE     C
C     OR THE OUTPUT OF RESULTS.  THE PARAMETERS ARE THE FOLLOWING:            C
C        VARB--CHARACTER STRING DESCRIBING WHAT UNITS ARE TO BE SELECTED FOR  C
C        UNITS--UNITS AVAILABLE TO CHOOSE FROM                                C
C        ICHOS--RETURNS WHICH OF THE UNITS WAS CHOSEN                         C
C        ICNT--NUMBER OF DIFFERENT UNITS AVAILABLE TO CHOOSE FROM             C
C-----------------------------------------------------------------------------C

      SUBROUTINE ASKUN (VARB,UNITS,ICHOS,ICNT)
      CHARACTER VARB*(*),UNITS(ICNT)*6,UNITIN*6

30    WRITE (5,66) VARB
      WRITE (5,55) (I,UNITS(I),I=1,ICNT)
      READ (7,44) ICHOS
      IF ( (ICHOS-1)*(ICHOS-ICNT) .GT. 0)   GOTO 30

      RETURN
44    FORMAT (BN,I60)
55    FORMAT (I10,')',5X,A)
66    FORMAT (//' SELECT UNITS FOR ',A)
      END
```

```
C--SUBROUTINE PTILE---------------------------------------------------------C
C     PTILE COMPUTES A PERCENTILE POINT, SPECIFIED BY THE USER, OF A BODY   C
C     DIMENSION USED AS A PREDICTOR, BY ASSUMING THE DIMENSION IS           C
C     NORMALLY DISTRIBUTED.  THE PARAMETERS ARE THE FOLLOWING:              C
C        ISUB--SPECIFIES SUBJECT TYPE, AND THUS WHICH POSITION OF THE       C
C           MEAN AND STANDARD ARRAYS TO USE.                                C
C        IDIM--THE DIMENSION A PERCENTILE POINT IS TO BE COMPUTED FOR       C
C        PRED--RETURNS THE COMPUTED PERCENTILE POINT                        C
C     NOTE:  THIS ROUTINE REQUIRES USE OF IMSL ROUTINE MDNRIS               C
C---------------------------------------------------------------------------C

      SUBROUTINE PTILE (ISUB,IDIM,PRED)
      COMMON /NAMES/ SUBTYP(10),SEGLAB(15),JNTLAB(14),PLTSYM(29),
     &               DIMNM(-1:31),TITLE,UNITS(3,-1:2)                 80386
      REAL MEAN(0:1,2:3), STDEV(0:1,2:3)
      CHARACTER SUBTYP*35,SEGLAB*3,JNTLAB*2,PLTSYM*1,DIMNM*24         80386
      CHARACTER TITLE*60,UNITS*6
      DATA MEAN,STDEV/127.24,63.82,173.54,69.82,16.57,2.36,21.42,2.44/

10    WRITE (5,111) DIMNM(IDIM)
      READ (7,99) PCENT
      IF ( (PCENT-1.)*(PCENT-100.)  .GE. 0.)  GOTO 10
      WRITE (9,222) DIMNM(IDIM),PCENT
      PCENT = PCENT/100.

      CALL NDTRI (PCENT,X,D,IER)
      PRED = MEAN(IDIM,ISUB) + X*STDEV(IDIM,ISUB)

      RETURN
99    FORMAT (F40.0)
111   FORMAT (' ENTER DESIRED PERCENTILE FOR ',A/
     &        ' (A REAL VALUE BETWEEN 0. AND 100.)')
222   FORMAT (A40,G15.4,'%-TILE')
      END
```

```
C--SUBROUTINE NDTRI-----------------------------------------------------C
C     NDTRI COMPUTES X (THE OUTPUT ARGUMENT SUCH THAT P=Y=THE           C
C     PROBABILITY THAT U, THE RANDOM VARIABLE, IS LESS THAN OR EQUAL    C
C     TO X.), D (THE OUTPUT DENSITY,F(X).), AND IER (THE OUTPUT         C
C     ERROR CODE.) USING P (THE INPUT PROBABILITY.).                    C
C-----------------------------------------------------------------------C

      SUBROUTINE NDTRI(P,X,D,IE)
C
      IE=0
      X=.99999E+38                                             80386
      D=X
      IF(P)1,4,2
1     IE=-1
      GO TO 12
2     IF (P-1.0)7,5,1
4     X=-.999999E+38                                           80386
5     D=0.0
      GO TO 12
C
7     D=P
      IF(D-0.5)9,9,8
8     D=1.0-D
9     T2=ALOG(1.0/(D*D))
      T=SQRT(T2)
      X=T-(2.515517+0.802853*T+0.010328*T2)/(1.0+1.432788*T+0.189269*T2
     &  +0.001308*T*T2)
      IF(P-0.5)10,10,11
10    X=-X
11    D=0.3989423*EXP(-X*X/2.0)
12    RETURN
      END
```

```
C--SUBROUTINE CONTAC-----------------------------------------------------------C
C     CONTAC COMPUTES JOINT LOCATIONS AND CONTACT ELLIPSOID SEMIAXES.          C
C-----------------------------------------------------------------------------C

      SUBROUTINE CONTAC
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV                                80386
      COMMON /SGMNTS/ AN(15),BN(15),CN(15),RMN(15),PHI(3,15),XYZCG(15,3)
      COMMON /JNTS/ RNJ(3,28),JNT(14),YPRLL(14,6),IPIN(14)               80386
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(3),                   80386
     &              RANGE(2,-1:1,3),CONV(-1:1)                           80386

C    THE CENTERS OF GRAVITY AND JOINT X,Y COORDINATES ARE ALL SET TO ZERO.
      DO 10 J=1,3
      DO 10 I=1,15
   10 XYZCG(I,J)=0.0
      DO 20 J=1,2
      DO 20 I=1,28
   20 RNJ(J,I)=0.0

C     NON-ZERO X,Y JOINT COORDINATES ARE COMPUTED.
      RNJ(1,21)=DD(29)*0.5
      RNJ(1,24)=RNJ(1,21)
      RNJ(2,5)=0.5*(DD(16)-DD(24)/PI)
      RNJ(2,8)=-RNJ(2,5)
      RNJ(2,11)=0.5*(DD(10)-DD(19)/PI)
      RNJ(2,13)=-RNJ(2,11)

C     SMW IS ONE HALF THE HEIGHT OF THE ABDOMEN SEGMENT.
C     OLAP IS USED AS AN OVERLAP AMOUNT BETWEEN CERTAIN CONTACT ELLIPSOIDS.
      SMW = (DD(2) - DD(4))/10.
      OLAP = DD(9)/PI

C     Z COORDINATES OF JOINTS ARE COMPUTED RELATIVE TO SEGMENT JNT(J),
C     WHERE J IS THE SECOND SUBSCRIPT OF RNJ
      RNJ(3,1) = (DD(1) - DD(5) - DD(4) + SMW)/2.
      RNJ(3,2) = -SMW
      RNJ(3,3) = -9.*SMW/2.
      RNJ(3,4) = (DD(8) + DD(2) - DD(1) + OLAP/2.)/2.
      RNJ(3,5) = (DD(4) - SMW - DD(1) + DD(5) - DD(24)/PI)/2.
      RNJ(3,6)=0.5*(DD(1)-DD(5)-DD(23)+DD(24)/PI)
      RNJ(3,7)=0.5*(DD(23)-DD(29)-DD(28)/PI2)
      RNJ(3,8) = RNJ(3,5)
      RNJ(3,9)=RNJ(3,6)
      RNJ(3,10)=RNJ(3,7)
      RNJ(3,11)=-DD(2)+DD(3)+DD(19)/PI2
      RNJ(3,12)=0.5*(DD(17)-DD(20)/PI)
      RNJ(3,13)=RNJ(3,11)
      RNJ(3,14)=RNJ(3,12)

C     Z COORDINATES OF JOINTS ARE COMPUTED RELATIVE TO SEGMENT J-13,
C     WHERE J IS THE SECOND SUBSCRIPT OF RNJ
      RNJ(3,15) = SMW
```

```
      RNJ(3,16) = -RNJ(3,3)
      RNJ(3,17) = (DD(1) - DD(8) - DD(2) - OLAP/2.)/2.
      RNJ(3,18) = DD(8) /2. + OLAP/4.
      RNJ(3,19)=0.5*(-DD(1)+DD(5)+DD(23)-DD(26)/PI)
      RNJ(3,20) = (DD(29) - DD(23) - DD(28)/PI2 + DD(26)/PI)/2.
      RNJ(3,21) = DD(28)/PI2 - DD(31)/2.
      RNJ(3,22)=RNJ(3,19)
      RNJ(3,23)=RNJ(3,20)
      RNJ(3,24)=RNJ(3,21)
      RNJ(3,25)=0.5*(DD(19)/PI-DD(17))
      RNJ(3,26)=0.5*(DD(20)/PI-DD(18))
      RNJ(3,27)=RNJ(3,25)
      RNJ(3,28)=RNJ(3,26)

C     SEGMENT CONTACT ELLIPSOID X SEMIAXES ARE COMPUTED.
      AN(5)=DD(6)*0.5
      AN(4)=DD(9)/PI2
      AN(3)=DD(11)*0.5
      AN(2)=DD(13)*0.5
      AN(1)=DD(15)*0.5
      AN(6)=(DD(24)+DD(25))/PI4
      AN(7)=DD(27)/PI2
      AN(8)=DD(29)*0.5
      AN(9)=AN(6)
      AN(10)=AN(7)
      AN(11)=AN(8)
      AN(12)=DD(19)/PI2
      AN(13)=DD(21)/PI2
      AN(14)=AN(12)
      AN(15)=AN(13)

C     SEGMENT CONTACT ELLIPSOID Y SEMIAXES ARE COMPUTED.
      BN(5)=DD(7)*0.5
      BN(4)=AN(4)
      BN(3)=DD(12)*0.5
      BN(2)=DD(14)*0.5
      BN(1)=DD(16)*0.5
      BN(6)=AN(6)
      BN(7)=AN(7)
      BN(8)=DD(30)*0.5
      BN(9)=AN(9)
      BN(10)=AN(10)
      BN(11)=BN(8)
      BN(12)=AN(12)
      BN(13)=AN(13)
      BN(14)=AN(14)
      BN(15)=AN(15)

C     SEGMENT CONTACT ELLIPSOID Z SEMIAXES ARE COMPUTED.
      CN(5) = (DD(8) + OLAP/2.)/2.
      CN(4) = (DD(1) - DD(8) - DD(2) + OLAP/2.)/2.
      CN(3) = 9.*SMW/2.
```

```
      CN(2) = SMW + OLAP/2.
      CN(1) = (DD(4)+DD(5)-DD(1) - SMW)*0.5
      CN(6)=(DD(1)-DD(5)-DD(23)+DD(24)/PI+DD(26)/PI)*0.5
      CN(7)=(DD(23)-DD(29)+DD(28)/PI2)*0.5
      CN(8)=DD(31)*0.5
      CN(9)=CN(6)
      CN(10)=CN(7)
      CN(11)=CN(8)
      CN(12)=DD(17)*0.5
      CN(13)=DD(18)*0.5
      CN(14)=CN(12)
      CN(15)=CN(13)

C     THE GLOBAL LOCATION OF SEGMENT CENTERS IS PLACED IN XYZCG FOR
C        SEGMENTS THAT WILL USE ELLIP IN COMPUTATION OF MASS AND
C        MOMENTS OF INERTIA.
      XYZCG(1,3) = (DD(4) - SMW +  D(1) - DD(5))/2.
      XYZCG(2,3) = DD(4)
      XYZCG(3,3) = DD(2) - 9.*SMW/2.
      XYZCG(8,3) = DD(29) - DD(31)/2. + DD(28)/PI2
      XYZCG(11,3) = XYZCG(8,3)

      RETURN
      END
```

```
C--SUBROUTINE SEGMAS---------------------------------------------------C
C     SEGMAS COMPUTES APPROXIMATE SEGMENT MASSES.  WTCOR IS THEN COMPUTED     C
C      TO ADJUST BODY DENSITY, DENS, SO THAT TOTAL BODY MASS AGREES           C
C     WITH DD(0).  SEGMENT MASSES ARE THEN RECOMPUTED USING WTCOR.            C
C----------------------------------------------------------------------C

      SUBROUTINE SEGMAS
C     EXTERNAL TORSO, FEET                                              80386
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV
      COMMON /CYL/ ZEES(0:15),ZH(15),NSEG(15),CGZ(15),WTCOR
      COMMON /JNTS/ RNJ(3,28),JNT(14),YPRLL(14,6),IPIN(14)              80386
      COMMON /SGMNTS/ ABCN(15,3),RMN(15),PHI(45),XYCG(30),ZCG(15)
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(3),                  80386
     &              RANGE(2,-1:1,3),CONV(-1:1)                          80386
      REAL AN(15),BN(15),CN(15)
      EQUIVALENCE (AN,ABCN),(BN,ABCN(1,2)),(CN,ABCN(1,3))
      SUMM=0.0

C     POSITIONS 0 THRU 3 OF ZEES DEFINE THE VERTICAL LIMITS OF TORSO
C        SEGMENTS.  10 THRU 11 DEFINE THE LIMITS OF THE FEET.
      SMW = (DD(2) - DD(4))/10.
      ZEES(0) = DD(1) - DD(5)
      ZEES(1) = DD(4) - SMW
      ZEES(2) = DD(4) + SMW
      ZEES(3) = DD(2)
      ZEES(11) = DD(29) + DD(28)/PI2
      ZEES(10) = ZEES(11) - DD(31)
      DO 5 I = 1,3
         CALL ELLIP (I,1,RMN(I))                                        80386
         ZCG(I) = CGZ(I) - ZCG(I)
5        SUMM = SUMM + RMN(I)
      CALL ELLIP (11,2,RMN(11))                                         80386
      SUMM = SUMM + 2.*RMN(11)
      RMN(8) = RMN(11)
      ZCG(11) = CGZ(11) - ZCG(11)
      ZCG(8) = ZCG(11)
      DO 7 I = 1,3
7        RNJ(3,I) = RNJ(3,I) + ZCG(I)
      RNJ(3,15) = ZCG(2) + RNJ(3,15)
      RNJ(3,16) = ZCG(3) + RNJ(3,16)
      RNJ(3,5) = ZCG(1) + RNJ(3,5)
      RNJ(3,8) = ZCG(1) + RNJ(3,8)
      RNJ(3,11) = RNJ(3,11) + ZCG(3)
      RNJ(3,13) = RNJ(3,13) + ZCG(3)
      RNJ(3,21) = RNJ(3,21) + ZCG(8)
      RNJ(3,24) = RNJ(3,24) + ZCG(11)
      DO 10 I = 4,7
      RMN(I) = 4.0/3.0*PI*AN(I)*BN(I)*CN(I)*DENS
      SUMM = SUMM+RMN(I)
      IF (I.GT.5)  THEN
         SUMM = SUMM + RMN(I)
         RMN(I+3) = RMN(I)
```

```
      ENDIF
   10 CONTINUE
      DO 15 I = 12,13
      RMN(I) = 4.0/3.0*PI*AN(I)*BN(I)*CN(I)*DENS
      SUMM = SUMM+2.*RMN(I)
   15 RMN(I+2) = RMN(I)
C
C     THE FOLLOWING ADJUSTS SEGMENT MASSES TO TOTAL BODY WEIGHT
C
      WTCOR = DD(0)/SUMM/GRAV
      DO 20 I=1,15
      RMN(I)=RMN(I)*WTCOR
   20 CONTINUE
      RETURN
      END
```

```
C--SUBROUTINE SGINER-------------------------------------------------------C
C     SGINER COMPUTES SEGMENT MOMENTS OF INERTIA.                          C
C--------------------------------------------------------------------------C

      SUBROUTINE SGINER
C     EXTERNAL TORSO, FEET                                            80386
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV                             80386
      COMMON /SGMNTS/ AN(15),BN(15),CN(15),RMN(15),PHI(3,15),XYZCG(15,3)80386

      DO 5 I=1,3
5        CALL ELLPMI (I,1,PHI(1,I))                                   80386
      DO 10 I=4,7
      TEMP=RMN(I)/5.0
      A2=AN(I)*AN(I)
      B2=BN(I)*BN(I)
      C2=CN(I)*CN(I)
      PHI(1,I)=TEMP*(B2+C2)
      PHI(2,I)=TEMP*(A2+C2)
      PHI(3,I)=TEMP*(A2+B2)
      IF (I.GT.5) THEN
         DO 7 J = 1,3
7           PHI(J,I+3) = PHI(J,I)
      ENDIF
   10 CONTINUE
      DO 20 I=12,13
      TEMP=RMN(I)/5.0
      A2=AN(I)*AN(I)
      B2=BN(I)*BN(I)
      C2=CN(I)*CN(I)
      PHI(1,I)=TEMP*(B2+C2)
      PHI(2,I)=TEMP*(A2+C2)
      PHI(3,I)=TEMP*(A2+B2)
      DO 15 J = 1,3
15        PHI(J,I+2) = PHI(J,I)
   20 CONTINUE
      CALL ELLPMI (11,2,PHI(1,11))                                    80386
      DO 25 J=1,3
25       PHI(J,8) = PHI(J,11)
      RETURN
      END
```

```
C--SUBROUTINE ELLIP-----------------------------------------------------C
C     ELLIP COMPUTES MASS AND CENTER OF GRAVITY LOCATION OF A RIGHT      C
C     ELLIPTICAL SOLID.  THE PARAMETERS ARE:                             C
C        ISEG--SPECIFIES SEGMENT BEING MODELLED BY RIGHT ELLIPTICAL SOLID  C
C        IABEVAL--SPECIFIES SUBOUTINE TO BE USED TO COMPUTE SEMIAXES OF THE  C
C           THE SOLID AT SPECIFIC Z HEIGHTS.                             C
C        TMASS--RETURNS THE MASS COMPUTED FOR THE SOLID.                 C
C-----------------------------------------------------------------------C

      SUBROUTINE ELLIP (ISEG,IABEVAL,TMASS)                           80386
      COMMON /CYL/ ZEES(0:15),ZH(15),NSEG(15),CGZ(15),WTCOR
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV
      REAL IXX,IXXP,IYY,IYYP,IZZ,IZZP
      REAL MASS
      REAL MI(3)
      TMASSO=0.0
      Z0 = ZEES(ISEG-1)
      Z1 = ZEES(ISEG)
      NSEG(ISEG)=0.0
10    NSEG(ISEG)=NSEG(ISEG)+10
      TCGN=0.0
      TMASS=0.0
      ZH(ISEG)=(Z1-Z0)/FLOAT(NSEG(ISEG))
        DO 100 I=1,NSEG(ISEG)
        Z = Z0 + (FLOAT(I-1)+.5)*ZH(ISEG)
        IF (IABEVAL.EQ.1) THEN                                        80386
           CALL TORSO(Z,A,B)                                          80386
        ELSE IF (IABEVAL.EQ.2) THEN                                   80386
           CALL FEET(Z,A,B)                                           80386
        ELSE                                                          80386
           STOP  'FROM ELLIP (IABEVAL)'                               80386
        END IF                                                        80386
        MASS=PI*A*B*ZH(ISEG)*DENS
        CG=Z
        CGN=CG*MASS
        TMASS=TMASS+MASS
100     TCGN=TCGN+CGN
      TMASSN=TMASS
      IF (ABS(TMASSN-TMASSO)/TMASSN.GT.5.E-5)  THEN
         TMASSO = TMASSN
         GOTO10
      ENDIF
      CGZ(ISEG)=TCGN/TMASS
      RETURN

C  ENTRY ELLPMI
C     ELLPMI COMPUTES MOMENTS OF INERTIA OF A RIGHT ELLIPTICAL SOLID, BASED
C     ON THE NUMERICAL INTEGRATION DETERMINED BY ELLIP.  THE FIRST TWO
C     PARAMETERS ARE THE SAME AS THOSE USED BY ELLIP.  THE THIRD, MI,
C     RETURNS THE MOMENTS OF INERTIA OF THE SOLID.

      ENTRY ELLPMI (ISEG,IABEVAL,MI)                                  80386
```

```
      DO 5 I=1,3
5     MI(I)=0.0
      Z0 = ZEES(ISEG-1)
      DO 200 I=1,NSEG(ISEG)
      Z = Z0 + (FLOAT(I-1)+.5)*ZH(ISEG)
      IF (IABEVAL.EQ.1) THEN                                    80386
         CALL TORSO(Z,A,B)                                      80386
      ELSE IF (IABEVAL.EQ.2) THEN                               80386
         CALL FEET(Z,A,B)                                       80386
      ELSE                                                      80386
         STOP  'FROM ELLPMI (IABEVAL)'                          80386
      END IF                                                    80386
      MASS=PI*A*B*ZH(ISEG)*DENS*WTCOR
      IXX=(MASS/12)*(3.0*B**2+ZH(ISEG)**2)
      IYY=(MASS/12)*(3.0*A**2+ZH(ISEG)**2)
      IZZ=(MASS/4.0)*(A**2+B**2)
      DIST=Z-CGZ(ISEG)
      IXXP=IXX+MASS*DIST**2
      IYYP=IYY+MASS*DIST**2
      IZZP=IZZ
      MI(1)=MI(1)+IXXP
      MI(2)=MI(2)+IYYP
      MI(3)=MI(3)+IZZP
200   Z=Z+ZH(ISEG)
    RETURN
    END
```

```
C--SUBROUTINE TORSO-------------------------------------------------------------C
C     TORSO COMPUTES SEMIAXIS VALUES FOR THE RIGHT ELLIPTICAL MODEL OF THE     C
C     THREE TORSO SEGMENTS.  THE PARAMETERS ARE THE FOLLOWING:                 C
C        Z--VERTICAL LOCATION AT WHICH THE SEMIAXES ARE TO BE COMPUTED         C
C        X--RETURNS X SEMIAXIS                                                 C
C        Y--RETURNS Y SEMIAXIS                                                 C
C-------------------------------------------------------------------------------C

      SUBROUTINE TORSO (Z,X,Y)
      COMMON /DIMS/ D(-1:31),REGEQ(24,-1:31),PRED(3),                  80386
     &              RANGE(2,-1:1,3),CONV(-1:1)                         80386
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV                              80386
      REAL H2,H3,H4,H5,H6

C     H2--TOP OF SOLID
C     H3--BREAK BETWEEN TOP SEMI-ELLIPSOID AND TOP FRUSTRUM
C     H4--BREAK BETWEEN TWO FRUSTRUM
C     H5--BREAK BETWEEN BOTTOM FRUSTUM AND BOTTOM SEMI-ELLIPSOID
C     H6--BOTTOM OF SOLID

      H2=D(2)
      H3=D(3)
      H4=D(4)
      H5=(D(1)-D(5))+D(24)/PI2
      H6=(D(1)-D(5))
      IF (Z.LT.H4)THEN
         IF (Z.LT.H5)THEN
            IF (Z.LT.H6)STOP 'Z IS LESS THAN MIN.'
           Y= SQRT(1. - ((Z - H5)/D(24)/PI2)**2)
           X = D(15)/2.*Y
           Y = D(16)/2.*Y
         ELSE
            Y=(Z-D(4))/(H5-D(4))
            X = (Y*(D(15)-D(13))  +D(13))/2.
            Y = (Y*(D(16)-D(14))  +D(14))/2.
         END IF
      ELSE
         IF(Z.LT.H3)THEN
            Y=(Z-D(3))/(D(4)-D(3))
            X= (Y*(D(13)-D(11))+D(11))/2.
            Y= (Y*(D(14)-D(12))+D(12))/2.
         ELSE
            IF (Z.GT.H2)   STOP 'Z IS GREATER THAN MAX.'
            Y=SQRT(1. - ( (Z - D(3))/(D(2) - D(3)) )**2)
            X= Y*D(11)/2.
            Y= Y*D(12)/2.
         END IF
      END IF
      END
```

```
C--SUBROUTINE FEET-----------------------------------------------------C
C     FEET COMPUTES SEMIAXIS VALUES FOR THE RIGHT ELLIPTICAL MODEL OF THE    C
C     FEET.  THE PARAMETERS ARE THE FOLLOWING:                               C
C        Z--Z LOCATION (TOE TO HEEL) AT WHICH SEMIAXES ARE TO BE COMPUTED    C
C        X--RETURNS X SEMIAXIS                                               C
C        Y--RETURNS Y SEMIAXIS                                               C
C----------------------------------------------------------------------C

      SUBROUTINE FEET (Z,X,Y)
      COMMON /CYL/ ZEES(0:15),ZH(15),NSEG(15),CGZ(15),WTCOR
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(3),                 80386
     &              RANGE(2,-1:1,3),CONV(-1:1)                         80386
      COMMON /FLOAT/ PI,PI2,PI4,DENS,GRAV                              80386

C     H2--TOP OF SOLID
C     H1--BREAK BETWEEN ELLIPTICAL CYLINDER AND FRUSTRUM
C     HO--BOTTOM OF SOLID

      ANKR = DD(28)/PI2
      H2 = DD(29) + ANKR
      H1 = DD(29) - ANKR
      HO = H2 - DD(31)

      IF (Z.GT.H1)  THEN
         IF (Z.GT.H2)  STOP  'Z VALUE TOO LARGE IN FEET'
         X = ANKR
         Y = ANKR
      ELSE
         IF (Z.LT.HO)  STOP 'Z VALUE TOO SMALL IN FEET'
         X = ANKR/(DD(31) - 2.*ANKR)*(Z - DD(29) + DD(31) - ANKR)
         Y = (ANKR - DD(30)/2.)/(DD(31) - 2.*ANKR)
         Y = Y*(Z - DD(29) + ANKR) + ANKR
      ENDIF

      RETURN
      END
```

```
C--SUBROUTINE RESULTS-------------------------------------------------C
C     RESULTS WRITES OUT THE COMPUTED BODY DESCRIPTION DATA.          C
C---------------------------------------------------------------------C
      SUBROUTINE RESULTS (ISTRT)
      COMMON /SGMNTS/ A(15),B(15),C(15),RMN(15),PHI(3,15),
     &                XCG(15),YCG(15),ZCG(15)
      COMMON /JNTS/ RNJ(3,14,2),JNT(14),YPRLL(14,6),IPIN(14)
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(3),               80386
     &              RANGE(2,-1:1,3),CONV(-1:1)                       80386
      COMMON /NAMES/ SUBTYP(10),SEGLAB(15),JNTLAB(14),PLTSYM(29),
     &               DIMLAB(-1:31),TITLE,UNITS(3,-1:2)
      COMMON /CYL/ ZEES(0:15),ZH(15),NSEG(15),CGZ(15),WTCOR
      CHARACTER SUBTYP*35,SEGLAB*3,JNTLAB*2,PLTSYM*1,DIMLAB*24,TITLE*60 80386
      CHARACTER ANS*1,UNITS*6,LABL1(2)*6,LABL2(2)*12,LABL3(2)*2,
     &          LABL4(2)*4 ,VARB*6
      INTEGER ID2(14,3)                                              REV1/87
      DATA LABL1,LABL2,LABL3,LABL4 /'WEIGHT','MASS','LB-SEC**2-IN',
     &     ' N-SEC**2-M ','IN. ','M.','LB.','N.'/,VARB/'OUTPUT'/
      DATA ID2/6*0,2,0,0,2,0,2,0,2,6*0,3,0,0,3,0,3,0,3,6*0,          REV1/87
     &         1,0,0,1,0,1,0,1/                                      REV1/87

      WRITE (9,11)
      CALL ASKUN (VARB,UNITS(1,2),IUN,2)
      CALL CNVRT (IUN)
      IF (ISTRT.LT.0) WRITE (9,22) -1,DIMLAB(-1),DD(-1),UNITS(1,-1)
      WRITE (9,22) 0,DIMLAB(0),DD(0),UNITS(IUN,0)
      WRITE (9,22) (I,DIMLAB(I),DD(I),UNITS(IUN,1),I=1,31)
      WRITE (9,66) WTCOR

      WRITE (9,44) '1'//TITLE
      WRITE(9,1170) LABL1(IUN),LABL2(IUN),LABL3(IUN),LABL3(IUN),
     &              LABL4(IUN)
      WRITE(9,1180) (I,SEGLAB(I),PLTSYM(I),RMN(I),(PHI(J,I),J=1,3),
     &       A(I),B(I),C(I),XCG(I),YCG(I),ZCG(I),I=1,15)
      WRITE(9,1190) LABL3(IUN),LABL3(IUN)
      WRITE(9,1200) (I,JNTLAB(I),PLTSYM(I+15),JNT(I),IPIN(I),
     &  ((RNJ(J,I,K),J=1,3),K=1,2),(YPRLL(I,J),J=1,6),I=1,14)
      WR    201)                                                     REV1/87

10    WR    ,33)
      READ  ,44) ANS
      IF (ANS.EQ.'Y'.OR.ANS.EQ.'y')  THEN                            80386
         WRITE (3,77) TITLE(1.52)
         WRITE(3,1300) (SEGLAB(I),PLTSYM(I),RMN(I),(PHI(J,I),J=1,3),
     &        A(I),B(I),C(I),XCG(I),YCG(I),ZCG(I),I=1,15)
C
         WRITE(3,1320) (JNTLAB(I),PLTSYM( +15),JNT(I),IPIN(I),
     &        ((RNJ(J,I,K),J=1,3),K=1,2),
     &        (YPRLL(I,J),J=1,6),(ID2(I,J),J=1,3),I=1,14)            REV1/87
      ELSE
         IF (ANS.NE.'N'.AND.ANS NE 'n')  GOTO 10                     80386
      ENDIF
```

```
20    WRITE (5,55)
      READ (7,44) ANS
      IF (ANS.EQ.'N'.OR.ANS.EQ.'n')  STOP 'FROM RESULTS'                80386
      IF (ANS.NE.'Y'.AND.ANS.NE.'y')  GOTO 20                           80386
      RETURN

11    FORMAT ('-COMPUTED BODY DIMENSIONS'/)
22    FORMAT (I10,A30,G15.4,A6)
33    FORMAT (//' IS ATB MODEL FORMATTED OUTPUT DESIRED (Y/N) ?')
44    FORMAT (A)
55    FORMAT (//' IS IT DESIRED TO PRODUCE ANOTHER BODY DESCRIPTION ',
     &        'DATA SET (Y/N) ?')
66    FORMAT ('OWEIGHT CORRECTION FACTOR =',F10.3)
77    FORMAT (4X,'15',4X,'14',8X,A52,'CARD B.1')
 1170 FORMAT(         1HO,"CRASH VICTIM PARAMETERS (3-D)"/1H0,33X,
     1 25HSEGMENT MOMENT OF INERTIA,
     2 19X,25HSEGMENT CONTACT ELLIPSOID/5X,7HSEGMENT,7X,A6
     3,15X,'(',A12,')',17X,10HSEMIAXIS (,A2,')',14X,'CENTER (',
     4 A2,')'/3X,12HNO. SYM PLOT,4X,'(',A4,')',10X,1HX,10X,1HY,10X,
     51HZ,12X,1HX,6X,1HY,6X,1HZ,12X,1HX,7X,1HY,6X,1HZ/1H )
 1180 FORMAT ((3X,I2,2X,A4,A2,6X,F6.2,3X,3(4X,F7.5),5X,3(2X,F5.2),5X,3
     1(3X,F5.2)))
 1190 FORMAT(1H0,///3X,5HJOINT,16X,'LOCATION(',A2,') - SEG(JNT)',5X,
     1 'LOCATION(',A2,') - SEG(J+1)',2X,'PRIN. AXIS(DEG) - SEG(JNT)',
     2 ' PRIN. AXIS(DEG) - SEG(J+1)'/2X,'J SYM PLOT JNT PIN',
     3 4X,2(1X,'X',8X,'Y',8X,'Z',8X),2('YAW',5X,'PITCH',5X,'ROLL',6X)/)
 1200 FORMAT ((I3,A4,A3,2X,2I3,4(3F9.2,1X)))
1201  FORMAT(77X,'JOINTS RA, LA, RE, & LE ARE ORDERED PITCH, YAW, ROLL')REV1/87
 1300 FORMAT(A4,A2,F6.2,3F6.4,6F6.3,6X,'CARD B.2')
 1320 FORMAT(A4,1X,A1,2I4,6F6.2,22X,'CARD B.3'/14X,6F6.2,24X,3I2)       REV1/87

      END
```

```
C--SUBROUTINE CNVRT-------------------------------------------------------------C
C     CNVRT CONVERTS ALL OUTPUT DATA TO THE UNITS SELECTED BY THE USER          C
C-------------------------------------------------------------------------------C

      SUBROUTINE CNVRT (IUN)
      COMMON /SGMNTS/ ABC(15,3),RMN(15),PHI(3,15),XYZCG(15,3)
      COMMON /JNTS/ RNJ(3,28),JNT(14),YPRLL(14,6),IPIN(14)              80386
      COMMON /DIMS/ DD(-1:31),REGEQ(24,-1:31),PRED(3),                  80386
     &              RANGE(2,-1:1,3),CONVT(-1:1)                         80386
      REAL CONV(2,3)
      DATA CONV /1.,.0254,32.17405,143.1072,12.,106.2045/

      DO 100 I = 1,15
         DO 10 J = 1,3
            ABC(I,J) = ABC(I,J)*CONV(IUN,1)
            XYZCG(I,J) = XYZCG(I,J)*CONV(IUN,1)
10          PHI(J,I) = PHI(J,I)/CONV(IUN,3)
100      RMN(I) = RMN(I)*CONV(IUN,2)

      DO 200 I = 1,28
      DO 200 J = 1,3
200      RNJ(J,I) = RNJ(J,I)*CONV(IUN,1)

      IF (IUN.GT.1)   THEN
         DD(0) = DD(0)/CONV(1,2)*CONV(2,2)
         DO 300 I=1,31
300         DD(I) = DD(I)*CONV(2,1)
      ENDIF

      RETURN
      END
```

```
C--SUBROUTINE RESULTZ(ISUB)--------------------------------------------------C
C     RESULTZ WRITES OUT THE COMPUTED BODY DESCRIPTION DATA FOR ISUB GT 4.   C
C----------------------------------------------------------------------------C

      SUBROUTINE RESULTZ (ISUB)

      COMMON /NAMES/ SUBTYP(10),SEGLAB(15),JNTLAB(14),PLTSYM(29),
     &               DIMLAB(-1:31),TITLE,UNITS(3,-1:2)

      CHARACTER ANS*1,UNITS*6,VARB*6,SUBTYP*35,SEGLAB*3,                 80386
     &          JNTLAB*2,PLTSYM*1,DIMLAB*24,TITLE*60,HEADER*30

      VARB = 'OUTPUT'
      CALL ASKUN (VARB,UNITS(1,2),IUN,2)
   10 WRITE (5,33)
      READ (7,44) ANS
   50 READ (2,*) NUMREC,HEADER
      IF (HEADER.NE.SUBTYP(ISUB)) THEN
         DO 30 I=1,NUMREC
            READ (2)
   30    CONTINUE
         GOTO 50
      ELSE
         IF (IUN.EQ.2) THEN
            DO 40 I=1,NUMREC+1
               READ(2)
   40       CONTINUE
         ENDIF
      ENDIF
      IF (ANS.EQ.'Y'.OR.ANS.EQ.'y') THEN                                 80386
         CALL ATBOUT (IUN)
      ELSE
         IF (ANS.EQ.'N'.OR.ANS.EQ.'n') THEN                              80386
            CALL NOATBOUT (IUN)
         ELSE
            GOTO 10
         ENDIF
      ENDIF
20    WRITE (5,55)
      READ (7,44) ANS
      IF (ANS.EQ.'N'.OR.ANS.EQ.'n') STOP 'FROM RESULTZ'                  80386
      IF (ANS.NE.'Y'.AND.ANS.NE.'y') GOTO 20                             80386
      RETURN

33    FORMAT (//' IS ATB MODEL FORMATTED OUTPUT DESIRED (Y/N) ?')
44    FORMAT (A)
55    FORMAT (//' IS IT DESIRED TO PRODUCE ANOTHER BODY DESCRIPTION ',
     &        'DATA SET (Y/N) ?')

      END
```

```
C--SUBROUTINE ATBOUT(IUN)-------------------------------------------------C
C    ATBOUT WRITES OUT THE BODY DESCRIPTION DATA FOR ISUB GT 4             C
C    IN READABLE FORMAT AND ATB INPUT FORMAT                               C
C-------------------------------------------------------------------------C

      SUBROUTINE ATBOUT (IUN)

      CHARACTER SEG*4,JOINT(30)*4,CGS*1,JS*1,LABL2(2)*12,BLANK*4,
     &          LABL3(2)*3,LABL4(2)*4,BDYTTL(5)*30,KTITLE(5)*20,
     &          KTITLE2(5,50)*20
      INTEGER IDYPR(6),NS(3),JOINTF(30),NF(5),IPIN(30),
     &        IGLOB(30),IFLAG(30)
      REAL YPRPMI(3),YPR1(3),YPR2(3),YPR3(3),ANG(3),THETA(50),
     &     BD(6),PHI(3),SR(3,60),VISC(7),SPRING(5,90),X(30),
     &     Y(30),F(50)

      DATA LABL2,LABL3,LABL4 /'LB-SEC**2-IN',' N-SEC**2-M ',
     &     'IN.',' M.','LB.',' N.'/

      BLANK = '    '
      IPAGE = 1
C I/O CARDB.1
      READ (2,200) NSEG,NJNT,(BDYTTL(I),I=1,5)
      WRITE (3,300) NSEG,NJNT,(BDYTTL(I),I=1,5)
      WRITE (9,900) (BDYTTL(I),I=1,5),NSEG,NJNT,IPAGE
      WRITE (9,'(T121,''CARDS B.1'')')
      IPAGE = IPAGE+1
C I/O B.2 CARDS
      WRITE (9,902)
      WRITE (9,904) LABL2(IUN),LABL3(IUN),LABL3(IUN)
      WRITE (9,906) LABL4(IUN)
      DO 1 I=1,NSEG
         READ (2,202) SEG,CGS,W,(PHI(J),J=1,3),
     &   (BD(J),J=1,6),LPMI
         IF (IUN.EQ.1) THEN
            WRITE (3,302) SEG,CGS,W,(PHI(J),J=1,3),
     &      (BD(J),J=1,6),LPMI
         ELSE
            IF (IUN.EQ.2) THEN
               WRITE (3,303) SEG,CGS,W,(PHI(J),J=1,3),
     &         (BD(J),J=1,6),LPMI
            ENDIF
         ENDIF
C    I/O B.2.2 CARDS IF LPMI NE 0
        DO 14 M=1,3
   14      YPRPMI(M) = 0.0
         IF (LPMI.NE.0) THEN
            READ (2,204) (YPRPMI(J),J=1,3)
            WRITE (3,304) (YPRPMI(J),J=1,3)
         ENDIF
         WRITE (9,908) I,SEG,CGS,W,(PHI(J),J=1,3),
     &   (BD(J),J=1,6),(YPRPMI(J),J=1,3)
```

```
    1 CONTINUE
C I/O B.3 CARDS IF NJNT NE 0
      IF (NJNT.EQ.0) GOTO 5
      WRITE (9,910)
      WRITE (9,912) LABL3(IUN),LABL3(IUN)
      WRITE (9,914)
      DO 2 J=1,NJNT
         READ(2,206) JOINT(J),JS,JNT,IPIN(J),
     &   (SR(I,2*J-1),I=1,3),(SR(I,2*J),I=1,3),
     &   ISLIP,C1,C2
         WRITE (3,306) JOINT(J),JS,JNT,IPIN(J),
     &   (SR(I,2*J-1),I=1,3),(SR(I,2*J),I=1,3),
     &   ISLIP,C1,C2
         READ (2,208) (YPR1(I),I=1,3),(YPR2(I),I=1,3),
     &   (YPR3(I),I=1,3),(IDYPR(I),I=1,6)
         WRITE (3,308) (YPR1(I),I=1,3),(YPR2(I),I=1,3),
     &   (YPR3(I),I=1,3),(IDYPR(I),I=1,6)
         WRITE (9,916) J,JOINT(J),JS,JNT,IPIN(J),
     &   (SR(I,2*J-1),I=1,3),(SR(I,2*J),I=1,3),
     &   (YPR1(I),I=1,3),(YPR2(I),I=1,3)
 2    CONTINUE
C I/O B.4 CARDS
      WRITE (9,918) IPAGE
      IPAGE = IPAGE+1
      WRITE (9,'(T121,''CARDS B.4'')')
      WRITE (9,920)
      WRITE (9,922) LABL3(IUN),LABL4(IUN),LABL3(IUN),LABL4(IUN)
      WRITE (9,924)
      WRITE (9,926)
      DO 3 J=1,NJNT
         READ (2,210) (SPRING(I,3*J-2),I=1,5),
     &   (SPRING(I,3*J-1),I=1,5)
         WRITE (3,310) (SPRING(I,3*J-2),I=1,5),
     &   (SPRING(I,3*J-1),I=1,5)
         WRITE (9,928) J,JOINT(J),(SPRING(I,3*J-2),I=1,5),
     &   (SPRING(I,3*J-1),I=1,5)
C IF JOINT(J) J IS AN EULER JOINT(J), I/O ANOTHER CARD
         IFLAG(J) = 0
         IF (IABS(IPIN(J)).GE.5.AND.IABS(IPIN(J)).LE.7) THEN
            IF (ISLIP.EQ.0) IFLAG(J) = 1
         ELSE
            IF (IABS(IPIN(J)).EQ.4) THEN
               IFLAG(J) = 1
            ELSE
               IF (IPIN(J).LE.-8.AND.IPIN(J).GE.-10) IFLAG(J) = 1
            ENDIF
         ENDIF
         IF (IFLAG(J).EQ.1) THEN
            READ (2,210) (SPRING(I,3*J),I=1,5),
     &      (ANG(I),I=1,3)
            WRITE (3,310) (SPRING(I,3*J),I=1,5),
     &      (ANG(I),I=1,3)
```

```
            WRITE (9,929) (SPRING(I,3*J),I=1,5)
C     &     (ANG(I),I=1,3)
         ENDIF
    3 CONTINUE
C I/O B.5 CARDS
      WRITE (9,'(''-'',119X,''CARDS B.5'')')
      WRITE (9,930)
      WRITE (9,932)
      WRITE (9,934)
      WRITE (9,936)  LABL3(IUN),LABL4(IUN),LABL3(IUN),
     &LABL4(IUN),LABL3(IUN),LABL4(IUN),LABL3(IUN),LABL4(IUN)
      DO 4 J=1,NJNT
         READ (2,212) (VISC(I),I=1,7)
         WRITE (3,312) (VISC(I),I=1,7)
         WRITE (9,938) J,JOINT(J),(VISC(I),I=1,7)
C IF JOINT(J) J IS AN EULER JOINT(J), THEN I/O TWO MORE CARDS
         IF (IFLAG(J).EQ.1) THEN
            READ (2,212) (VISC(I),I=1,7)
            WRITE (3,312) (VISC(I),I=1,7)
            WRITE (9,939) (VISC(I),I=1,7)
            READ (2,212) (VISC(I),I=1,7)
            WRITE (3,312) (VISC(I),I=1,7)
            WRITE (9,939) (VISC(I),I=1,7)
         ENDIF
    4 CONTINUE
C I/O NJNTF FROM THE D.1 CARD
    5 READ (2,214) NJNTF
      WRITE (3,314) NJNTF
      WRITE (9,940) IPAGE
      IPAGE = IPAGE+1
      WRITE (9,942) NJNTF
C I/O E.1 CARDS
      NUM = 1
    6 READ (2,216) IONE,(KTITLE(I),I=1,5)
      WRITE (3,316) IONE,(KTITLE(I),I=1,5)
      IF (IONE.GT.50) GOTO 7
      IF (NUM.EQ.1) THEN
         WRITE (9,944) IPAGE
         IPAGE = IPAGE+1
         NUM = 2
      ELSE
         NUM = 1
         WRITE (9,'(//////)')
      ENDIF
      WRITE (9,946) IONE,(KTITLE(I),I=1,5)
C READ E.2 CARD
      READ (2,218) D0,D1,D2,D3,D4
      WRITE (3,318) D0,D1,D2,D3,D4
      WRITE (9,948)
      WRITE (9,950) D0,D1,D2,D3,D4
C I/O E.3 AND E.4 CARDS
      IF (D1.EQ.0) THEN
```

```
C        F1 - 'CONSTANT'
         WRITE (9,960) D2
      ELSE
         IF (D1.LT.0) THEN
C           F1 - 'TABULAR'
            READ (2,220) NPI
            READ (2,218) (X(I),Y(I),I-1,NPI)
            WRITE (3,320) NPI
            WRITE (3,322) (X(I),Y(I),I-1,NPI)
            WRITE (9,952) NPI
            WRITE (9,962)
            WRITE (9,964) (X(I),Y(I),I-1,NPI)
C IF D2 - 0, F2 DOES NOT EXIST
            IF (D2.GT.0) THEN
C              F2 - 'POLYNOMIAL'
               READ (2,218) A0,A1,A2,A3,A4,A5
               IF (IUN.EQ.1) THEN
                  WRITE (3,324) A0,A1,A2,A3,A4,A5
               ELSE
                  WRITE (3,326) A0,A1,A2,A3,A4,A5
               ENDIF
               WRITE (9,958)
               WRITE (9,966)
               WRITE (9,968) A0,A1,A2,A3,A4,A5
            ENDIF
         ELSE
            IF (D1.GT.0) THEN
C              F1 - 'POLYNOMIAL'
               READ (2,218) A0,A1,A2,A3,A4,A5
               IF (IUN.EQ.1) THEN
                  WRITE (3,324) A0,A1,A2,A3,A4,A5
               ELSE
                  IF (IUN.EQ.2) THEN
                     WRITE (3,326) A0,A1,A2,A3,A4,A5
                  ENDIF
               ENDIF
               WRITE (9,954)
               WRITE (9,966)
               WRITE (9,968) A0,A1,A2,A3,A4,A5
               IF (D2.LT.0) THEN
C                 F2 - 'TABULAR'
                  READ (2,220) NPI
                  READ (2,218) (X(I),Y(I),I-1,NPI)
                  WRITE (3,320) NPI
                  WRITE (3,322) (X(I),Y(I),I-1,NPI)
                  WRITE (9,956) NPI
                  WRITE (9,962)
                  WRITE (9,964) (X(I),Y(I),I-1,NPI)
               ELSE
                  IF (D2.GT.0) THEN
C                    F2 - 'POLYNOMIAL'
                     READ (2,218) A0,A1,A2,A3,A4,A5
```

```
                     IF (IUN.EQ.1) THEN
                        WRITE (3,324) A0,A1,A2,A3,A4,A5
                     ELSE
                        WRITE (3,326) A0,A1,A2,A3,A4,A5
                     ENDIF
                     WRITE (9,958)
                     WRITE (9,966)
                     WRITE (9,968) A0,A1,A2,A3,A4,A5
                  ENDIF
               ENDIF
            ENDIF
         ENDIF
      ENDIF
      GOTO 6
C I/O E.7 CARDS
    7 IF (NJNTF.NE.0) THEN
         DO 8 I=1,NJNTF
            READ (2,216) ITWO,(KTITLE2(J,ITWO),J=1,5)
            WRITE (3,328) ITWO,(KTITLE2(J,ITWO),J=1,5)
            WRITE (9,944) IPAGE
            IPAGE = IPAGE+1
            WRITE (9,970) ITWO,(KTITLE2(J,ITWO),J=1,5)
            READ (2)
            WRITE (3)
            READ (2,222) NTHETA,NPHI
            WRITE (3,330) NTHETA,NPHI
            IF (NTHETA.GT.0) THEN
               DO 15 K=2,NTHETA
                  THETA(K) = DFLOAT(K-1)*180.0/DFLOAT(NTHETA-1)
   15          CONTINUE
               WRITE (9,972) NTHETA,NPHI
               WRITE (9,974)
               WRITE (9,976) (THETA(J),J=2,NTHETA)
               WRITE (9,'('' '')')
            ELSE
               IF (NTHETA.LT.0) THEN
                  NPOLY = -NTHETA-1
                  WRITE (9,978) NPOLY,NPHI
                  WRITE (9,980)
                  WRITE (9,982) (BLANK,J,J=1,NPOLY)
                  WRITE (9)
               ENDIF
            ENDIF
            NTHETE = IABS(NTHETA)
            PHIDEG = 360.0/DFLOAT(NPHI)
            DO 9 K=1,NPHI
               READ (2,218) THETAO,(F(J),J=2,NTHETE)
               WRITE (3,332) THETAO,(F(J),J=2,NTHETE)
               DEG = PHIDEG*DFLOAT(K-1) - 180.0
               WRITE (9,984) DEG,THETAO,(F(J),J=2,NTHETE)
    9       CONTINUE
    8    CONTINUE
```

```
      ENDIF
C I/O F.4 CARDS
C   INITIALIZE IGLOB(J),J=1,18 SO 'CARD F.4' WILL PRINT OUT
      DO 10 J=1,18
   10 IGLOB(J) = 0
      IF (NJNT.NE.0) THEN
         READ (2,224) (IGLOB(J),J=1,NJNT)
         WRITE (3,334) (IGLOB(J),J=1,18)
         IF (NJNT.GT.18) THEN
            WRITE (3,334) (IGLOB(J),J=19,NJNT)
         ENDIF
         DO 11 J=1,NJNT
            IF (IGLOB(J).EQ.1) THEN
               READ (2,226) NJ,(NS(I),I=1,3),
     &         (NF(I),I=1,5)
               WRITE (3,226) NJ,(NS(I),I=1,3),
     &         (NF(I),I=1,5)
            ENDIF
   11    CONTINUE
      ENDIF
C I/O F.5 CARD
C   INITIALIZE JOINTF(J),J=1,18 TO ZERO SO 'CARD F.5' WILL PRINT
      DO 12 J=1,18
   12 JOINTF(J) = 0
      IF (NJNT.GT.0.AND.NJNTF.GT.0) THEN
         WRITE (9,986) IPAGE
         IPAGE = IPAGE+1
         READ (2,224) (JOINTF(J),J=1,NJNT)
         WRITE (3,336) (JOINTF(J),J=1,18)
         IF (NJNT.GT.18) THEN
            WRITE (3,336) (JOINTF(J),J=19,NJNT)
         ENDIF
         DO 13 K=1,NJNT
            NUMF = JOINTF(K)
            IF (NUMF.NE.0) THEN
               WRITE (9,988) K,JOINT(K),NUMF,
     &         (KTITLE2(I,NUMF),I=1,5)
            ENDIF
   13    CONTINUE
      ENDIF
C FINISHED CARD I/O
      RETURN

200   FORMAT (2I6,8X,5A6)
202   FORMAT (A4,1X,A1,10F6.0,I4)
204   FORMAT (12X,3F6.0)
206   FORMAT (A4,1X,A1,2I4,6F6.0,I4,2F6.0)
208   FORMAT (14X,9F6.0,6I2)
210   FORMAT (2(4F6.0,F12.0))
212   FORMAT (F6.0,4F6.0,18X,2F6.0)
214   FORMAT (48X,I6)
216   FORMAT (I4,4X,5A4)
```

```
218   FORMAT (6F12.0)
220   FORMAT (I6)
222   FORMAT (2I6)
224   FORMAT (18I4)
226   FORMAT (9I4)
300   FORMAT (2I6,8X,5A6,T73,'CARD B.1')
302   FORMAT (A4,1X,A1,F6.3,3F6.4,6F6.3,I4,T73,'CARD B.2')
303   FORMAT (A4,1X,A1,F6.2,3F6.4,6F6.3,I4,T73,'CARD B.2')
304   FORMAT (12X,2F6.2,F6.1)
306   FORMAT (A4,1X,A1,2I4,6F6.2,I4,2F6.2,T73,'CARD B.3')
308   FORMAT (14X,9F6.2,6I2)
310   FORMAT (2(4F6.2,F12.2),'CARD B.4')
312   FORMAT (F6.3,4F6.0,18X,2F6.0,T73,'CARD B.5')
314   FORMAT (48('X'),I6,6('X'),T73,'CARD D.1')
316   FORMAT (I4,4X,5A4,T73,'CARD E.1')
318   FORMAT (5F12.2,T73,'CARD E.2')
320   FORMAT (I6,66X,'CARD E.4')
322   FORMAT (6F12.2,'CARD E.4')
324   FORMAT (6F12.2,'CARD E.3')
326   FORMAT (6E12.5,'CARD E.3')
328   FORMAT (I4,4X,5A4,T73,'CARD E.7')
330   FORMAT (2I6,T73,'CARD E.7')
332   FORMAT (6F12.3,'CARD E.7')
334   FORMAT (18I4,'CARD F.4')
336   FORMAT (18I4,'CARD F.5')
900   FORMAT ('1 CRASH VICTIM      ',5A6,3X,I2,' SEGMENTS',3X,
     &I2,' JOINTS',T124,'PAGE',I4)                                 80386
902   FORMAT (T26,'PRINCIPAL MOMENTS OF INERTIA',T68,'SEGMENT',
     &' CONTACT ELLIPSIOD',T121,'CARDS B.2')
904   FORMAT (T4,'SEGMENT',T17,'WEIGHT',T32,'(',A12,')',T60,
     &'SEMIAXES (',A4,')',T87,'CENTER (',A4,')',
     &T111,'PRINCIPAL AXES (DEG)')
906   FORMAT ('  I  SYM PLOT   (',A4,')',T30,'X',T39,'Y',T48,
     &'Z',T59,'X',T67,'Y',T75,'Z',T85,'X',T93,'Y',T101,'Z',
     &T110,'YAW',T118,'PITCH',T128,'ROLL',/)
908   FORMAT (1X,I2,1X,A4,A3,F11.3,2X,3F9.4,2(2X,3F8.3),1X,3F9.2)
910   FORMAT ('-',T121,'CARDS B.3')
912   FORMAT ('    JOINT',T24,'LOCATION(',A4,') - SEG(JNT)    ',
     &'LOCATION(',A4,') - SEG(J+1)  PRIN. AXIS(DEG) - SEG',
     &'(JNT)  PRIN. AXIS(DEG) - SEG(J+1)')
914   FORMAT ('  J SYM PLOT PIN',T27,'X',T36,'Y',T45,'Z',T55,
     &'X',T64,'Y',T73,'Z',T82,'YAW',T90,'PITCH',T100,'ROLL',
     &T110,'YAW',T118,'PITCH',T128,'ROLL',/)
916   FORMAT (1X,I2,2A4,I5,I3,2(1X,3F9.3),2(1X,3F9.2))
918   FORMAT ('1 JOINT TORQUE CHARACTERISTICS',T124,'PAGE',
     &I4)
920   FORMAT (T24,'FLEXURAL SPRING CHARACTERISTICS',T83,
     &'TORSIONAL SPRING CHARACTERISTICS',/)
922   FORMAT (8X,2(7X,'SPRING COEF. (',2A4,'/DEG**J)',6X,
     &'ENERGY',5X,'JOINT'))
924   FORMAT ('  JOINT',2(9X,'LINEAR',4X,'QUADRATIC',5X,'CUBIC'
     &,4X,'DISSIPATION  STOP'))
```

```
926  FORMAT (8X,2(8X,'(J-1)',7X,'(J-2)',7X,'(J-3)',7X,'COEF.',
    &5X,'(DEG)'),/)
928  FORMAT (1X,I2,A4,2(3X,3F12.3,2F10.3))
929  FORMAT (10X,3F12.3,2F10.3)
930  FORMAT (T39,'JOINT VISCOUS CHARACTERISTICS AND LOCK-'
    &,'UNLOCK CONDITIONS',/)
932  FORMAT (T15,'VISCOUS',T31,'COULOMB',T45,'FULL FRICTION',
    &T63,'MAX TORQUE FOR',T81,'MIN TORQUE FOR',T99,'MIN. ',
    &'ANG. VELOCITY',T123,'IMPULSE')
934  FORMAT ('  JOINT',T13,'COEFFICIENT',T28,'FRICTION COEF. ',
    &'ANGULAR VELOCITY',T63,'A LOCKED JOINT',T81,'UNLOCKED ',
    &'JOINT',T121,'RESTITUTION')
936  FORMAT (T9,'(',2A4,' SEC/DEG)',T29,'(',2A4,')',T45,
    &'(DEG/ SEC)',T65,'(',2A4,')',T83,'(',2A4,')',T103,
    &'(RAD/ SEC)',T121,'COEFFICIENT',/)
938  FORMAT (1X,I2,A4,F14.3,2F15.2,4X,2F18.2,F20.2,F17.2)
939  FORMAT (7X,F14.3,2F15.2,4X,2F18.2,F20.2,F17.2)
940  FORMAT ('1',T6,'NPL',T13,'NBLT',T21,'NBAG',T29,'NELP',T39,
    &'NQ',T46,'NSD',T51,'NHRNSS',T59,'NWINDF',T68,'NJNTF',
    &T75,'NFORCE',T124,'PAGE',I4)
942  FORMAT (8(4X,'XXXX'),4X,I4,4X,'XXXX',T121,'CARD D.1')
944  FORMAT ('1',T124,'PAGE',I4)
946  FORMAT (' FUNCTION NO.',I4,T22,5A4,T121,'CARDS E.1',/)
948  FORMAT (T11,'D0',T26,'D1',T41,'D2',T56,'D3',T71,'D4')
950  FORMAT (1X,F14.4,4F15.4)
952  FORMAT ('-',T8,'FIRST PART OF FUNCTION - ',I4,' TABULAR ',
    &'POINTS',/)
954  FORMAT ('-',T8,'FIRST PART OF FUNCTION - 5TH DEGREE ',
    &'POLYNOMIAL',/)
956  FORMAT ('-',T8,'SECOND PART OF FUNCTION - ',I4,' TABULAR ',
    &'POINTS',/)
958  FORMAT ('-',T8,'SECOND PART OF FUNTION - 5TH DEGREE ',
    &'POLYNOMIAL',/)
960  FORMAT ('-',T8,'FUNCTION IS CONSTANT ',F11.6)
962  FORMAT (T9,'0',T26,'F(0)')
964  FORMAT (1X,F14.6,F15.4)
966  FORMAT (T9,'A0',T24,'A1',T39,'A2',T54,'A3',T69,'A4',T84,
    &'A5')
968  FORMAT (6E15.7)
970  FORMAT (5X,'JOINT FORCE FUNCTION NO. ',I4,T38,5A4,T121,
    &'CARD E.7'//)
972  FORMAT ('- FUNCTION IS TABULAR FOR ',I2,' X ',I2,' VALUES',
    &' OF THETA AND PHI',/)
974  FORMAT (T31,'THETA')
976  FORMAT (T6,'PHI',T14,'THETAO',F16.3,4F20.3/(15X,5F20.3))
978  FORMAT ('- FUNCTION IS COEFFICIENTS OF ',I2,' ORDER ',
    &'POLYNOMIALS IN (THETA-THETAO) FOR ',I2,' VALUES OF PHI')
980  FORMAT ('0',T28,'COEFFIECIENTS OF (THETA-THETAO)**N')
982  FORMAT (T6,'PHI',T14,'THETAO',7X,5(A4,'N =',I2,11X)/
    &(26X,A4,'N,=',I2,11X,A4,'N,=',I2,11X,A4,'NX=',I2,11X,A4,
    &'N =',I2,11X,A4,'N =',I2)  )
984  FORMAT (F9.2,F10.3,5G20.7/(19X,5G20.7))
```

```
986   FORMAT ('1',122X,'PAGE ',I4/120X,'CARD F.5'/
     &        ' THE FOLLOWING JOINT RESTORING FORCE FUNCTIONS AS DEFINED
     & ON CARDS E.7 WILL BE USED.'//4X,'JOINT',10X,'FUNCTION'//)
988   FORMAT (I6,'-',A4,I10,'-',5A4)

      END
```

```
C--SUBROUTINE NOATBOUT(IUN)--------------------------------------------------C
C    ATBOUT WRITES OUT THE BODY DESCRIPTION DATA FOR ISUB GT 4               C
C    IN READABLE FORMAT.                                                     C
C----------------------------------------------------------------------------C

      SUBROUTINE NOATBOUT (IUN)

      CHARACTER SEG*4,JOINT(30)*4,CGS*1,JS*1,LABL2(2)*12,BLANK*4,
     &          LABL3(2)*3,LABL4(2)*4,BDYTTL(5)*30,KTITLE(5)*20,
     &          KTITLE2(5,50)*20
      INTEGER IDYPR(6),NS(3),JOINTF(30),NF(5),IPIN(30),
     &        IGLOB(30),IFLAG(30)
      REAL YPRPMI(3),YPR1(3),YPR2(3),YPR3(3),ANG(3),THETA(50),
     &     BD(6),PHI(3),SR(3,60),VISC(7),SPRING(5,90),X(30),
     &     Y(30),F(50)

      DATA LABL2,LABL3,LABL4 /'LB-SEC**2-IN',' N-SEC**2-M ',
     &     'IN.',' M.','LB.',' N.'/

      BLANK = '    '
      IPAGE = 1
C I/O CARDB.1
      READ (2,200) NSEG,NJNT,(BDYTTL(I),I=1,5)
      WRITE (9,900) (BDYTTL(I),I=1,5),NSEG,NJNT,IPAGE
      WRITE (9,'(T121,''CARDS B.1'')')
      IPAGE = IPAGE+1
C I/O B.2 CARDS
      WRITE (9,902)
      WRITE (9,904) LABL2(IUN),LABL3(IUN),LABL3(IUN)
      WRITE (9,906) LABL4(IUN)
      DO 1 I=1,NSEG
         READ (2,202) SEG,CGS,W,(PHI(J),J=1,3),
     &   (BD(J),J=1,6),LPMI
C    I/O B.2.2 CARDS IF LPMI NE 0
         DO 14 M=1,3
   14       YPRPMI(M) = 0.0
         IF (LPMI.NE.0) THEN
            READ (2,204) (YPRPMI(J),J=1,3)
         ENDIF
         WRITE (9,908) I,SEG,CGS,W,(PHI(J),J=1,3),
     &   (BD(J),J=1,6),(YPRPMI(J),J=1,3)
    1 CONTINUE
C I/O B.3 CARDS IF NJNT NE 0
      IF (NJNT.EQ.0) GOTO 5
      WRITE (9,910)
      WRITE (9,912) LABL3(IUN),LABL3(IUN)
      WRITE (9,914)
      DO 2 J=1,NJNT
         READ(2,206) JOINT(J),JS,JNT,IPIN(J),
     &   (SR(I,2*J-1),I=1,3),(SR(I,2*J),I=1,3),
     &   ISLIP,C1,C2
         READ (2,208) (YPR1(I),I=1,3),(YPR2(I),I=1,3),
```

```
     &   (YPR3(I),I-1,3),(IDYPR(I),I-1,6)
         WRITE (9,916) J,JOINT(J),JS,JNT,IPIN(J),
     &   (SR(I,2*J-1),I-1,3),(SP.(I,2*J),I-1,3),
     &   (YPR1(I),I-1,3),(YPR2(I),I-1,3)
  2    CONTINUE
C I/O B.4 CARDS
       WRITE (9,918) IPAGE
       IPAGE - IPAGE+1
       WRITE (9,'(T121,''CARDS B.4'')')
       WRITE (9,920)
       WRITE (9,922) LABL3(IUN),LABL4(IUN),LABL3(IUN),LABL4(IUN)
       WRITE (9,924)
       WRITE (9,926)
       DO 3 J-1,NJNT
         READ (2,210) (SPRING(I,3*J-2),I-1,5),
     &   (SPRING(I,3*J-1),I-1,5)
         WRITE (9,928) J,JOINT(J),(SPRING(I,3*J-2),I-1,5),
     &   (SPRING(I,3*J-1),I-1,5)
C IF JOINT(J) J IS AN EULER JOINT(J), I/O ANOTHER CARD
         IFLAG(J) - 0
         IF (IABS(IPIN(J)).GE.5.AND.IABS(IPIN(J)).LE.7) THEN
            IF (ISLIP.EQ.0) IFLAG(J) - 1
         ELSE
            IF (IABS(IPIN(J)).EQ.4) THEN
               IFLAG(J) - 1
            ELSE
               IF (IPIN(J).LE.-8.AND.IPIN(J).GE.-10) IFLAG(J) - 1
            ENDIF
         ENDIF
         IF (IFLAG(J).EQ.1) THEN
            READ (2,210) (SPRING(I.3*J),I-1,5),
     &      (ANG(I),I-1,3)
            WRITE (9,929) (SPRING(I,3*J),I-1,5)
C    &      (ANG(I),I-1,3)
         ENDIF
    3 CONTINUE
C I/O B.5 CARDS
       WRITE (9,'(''-'',119X,''CARDS B.5'')')
       WRITE (9,930)
       WRITE (9,932)
       WRITE (9,934)
       WRITE (9,936)  LABL3(IUN),LABL4(IUN),LABL3(IUN),
     &LABL4(IUN),LABL3(IUN),LABL4(IUN),LABL3(IUN),LABL4(IUN)
       DO 4 J-1,NJNT
         READ (2,212) (VISC(I),I-1,7)
         WRITE (9,938) J,JOINT(J),(VISC(I),I-1,7)
C IF JOINT(J) J IS AN EULER JOINT(J), THEN I/O TWO MORE CARDS
         IF (IFLAG(J).EQ.1) THEN
            READ (2,212) (VISC(I),I-1,7)
            WRITE (9,939) (VISC(I),I-1,7)
            READ (2,212) (VISC(I),I-1,7)
            WRITE (9,939) (VISC(I),I-1,7)
```

```
         ENDIF
    4 CONTINUE
C I/O NJNTF FROM THE D.1 CARD
    5 READ (2,214) NJNTF
      WRITE (9,940) IPAGE
      IPAGE - IPAGE+1
      WRITE (9,942) NJNTF
C I/O E.1 CARDS
      NUM - 1
    6 READ (2,216) IONE,(KTITLE(I),I-1,5)
      IF (IONE.GT.50) GOTO 7
      IF (NUM.EQ.1) THEN
         WRITE (9,944) IPAGE
         IPAGE - IPAGE+1
         NUM - 2
      ELSE
         NUM - 1
         WRITE (9,'(//////)')
      ENDIF
      WRITE (9,946) IONE,(KTITLE(I),I-1,5)
C READ E.2 CARD
      READ (2,218) D0,D1,D2,D3,D4
      WRITE (9,948)
      WRITE (9,950) D0,D1,D2,D3,D4
C I/O E.3 AND E.4 CARDS
      IF (D1.EQ.0) THEN
C        F1 - 'CONSTANT'
         WRITE (9,960) D2
      ELSE
         IF (D1.LT.0) THEN
C           F1 - 'TABULAR'
            READ (2,220) NPI
            READ (2,218) (X(I),Y(I),I-1,NPI)
            WRITE (9,952) NPI
            WRITE (9,962)
            WRITE (9,964) (X(I),Y(I),I-1,NPI)
C IF D2 - 0, F2 DOES NOT EXIST
            IF (D2.GT.0) THEN
C              F2 - 'POLYNOMIAL'
               READ (2,218) A0,A1,A2,A3,A4,A5
               WRITE (9,958)
               WRITE (9,966)
               WRITE (9,968) A0,A1,A2,A3,A4,A5
            ENDIF
         ELSE
            IF (D1.GT.0) THEN
C              F1 - 'POLYNOMIAL'
               READ (2,218) A0,A1,A2,A3,A4,A5
               WRITE (9,954)
               WRITE (9,966)
               WRITE (9,968) A0,A1,A2,A3,A4,A5
               IF (D2.LT.0) THEN
```

```
C                 F2 - 'TABULAR'
                  READ (2,220) NPI
                  READ (2,218) (X(I),Y(I),I-1,NPI)
                  WRITE (9,956) NPI
                  WRITE (9,962)
                  WRITE (9,964) (X(I),Y(I),I-1,NPI)
               ELSE
                  IF (D2.GT.0) THEN
C                    F2 - 'POLYNOMIAL'
                     READ (2,218) A0,A1,A2,A3,A4,A5
                     WRITE (9,958)
                     WRITE (9,966)
                     WRITE (9,968) A0,A1,A2,A3,A4,A5
                  ENDIF
               ENDIF
            ENDIF
         ENDIF
      ENDIF
      GOTO 6
C I/O E.7 CARDS
    7 IF (NJNTF.NE.0) THEN
         DO 8 I-1,NJNTF
            READ (2,216) ITWO,(KTITLE2(J,ITWO),J-1,5)
            WRITE (9,944) IPAGE
            IPAGE - IPAGE+1
            WRITE (9,970) ITWO,(KTITLE2(J,ITWO),J-1,5)
            READ (2)
            READ (2,222) NTHETA,NPHI
            IF (NTHETA.GT.0) THEN
               DO 15 K-2,NTHETA
                  THETA(K) - DFLOAT(K-1)*180.0/DFLOAT(NTHETA-1)
   15          CONTINUE
               WRITE (9,972) NTHETA,NPHI
               WRITE (9,974)
               WRITE (9,976) (THETA(J),J-2,NTHETA)
               WRITE (9,'('' '')')
            ELSE
               IF (NTHETA.LT.0) THEN
                  NPOLY - -NTHETA-1
                  WRITE (9,978) NPOLY,NPHI
                  WRITE (9,980)
                  WRITE (9,982) (BLANK,J,J-1,NPOLY)
                  WRITE (9)
               ENDIF
            ENDIF
            NTHETE - IABS(NTHETA)
            PHIDEG - 360.0/DFLOAT(NPHI)
            DO 9 K-1,NPHI
               READ (2,218) THETAO,(F(J),J-2,NTHETE)
               DEG - PHIDEG*DFLOAT(K-1) - 180.0
               WRITE (9,984) DEG,THETAO,(F(J),J-2,NTHETE)
    9       CONTINUE
```

```
    8    CONTINUE
      ENDIF
C I/O F.4 CARDS
C   INITIALIZE IGLOB(J),J=1,18 SO 'CARD F.4' WILL PRINT OUT
      DO 10 J=1,18
   10 IGLOB(J) = 0
      IF (NJNT.NE.0) THEN
         READ (2,224) (IGLOB(J),J=1,NJNT)
         DO 11 J=1,NJNT
            IF (IGLOB(J).EQ.1) THEN
               READ (2,226) NJ,(NS(I),I=1,3),
     &         (NF(I),I=1,5)
            ENDIF
   11    CONTINUE
      ENDIF
C I/O F.5 CARD
C   INITIALIZE JOINTF(J),J=1,18 TO ZERO SO 'CARD F.5' WILL PRINT
      DO 12 J=1,18
   12 JOINTF(J) = 0
      IF (NJNT.GT.0.AND.NJNTF.GT.0) THEN
         WRITE (9,986) IPAGE
         IPAGE = IPAGE+1
         READ (2,224) (JOINTF(J),J=1,NJNT)
         DO 13 K=1,NJNT
            NUMF = JOINTF(K)
            IF (NUMF.NE.0) THEN
               WRITE (9,988) K,JOINT(K),NUMF,
     &         (KTITLE2(I,NUMF),I=1,5)
            ENDIF
   13    CONTINUE
      ENDIF
C FINISHED CARD I/O
      RETURN

200   FORMAT (2I6,8X,5A6)
202   FORMAT (A4,1X,A1,10F6.0,I4)
204   FORMAT (12X,3F6.0)
206   FORMAT (A4,1X,A1,2I4,6F6.0,I4,2F6.0)
208   FORMAT (14X,9F6.0,6I2)
210   FORMAT (2(4F6.0,F12.0))
212   FORMAT (F6.0,4F6.0,18X,2F6.0)
214   FORMAT (48X,I5)
216   FORMAT (I4,4X,5A4)
218   FORMAT (6F12.0)
220   FORMAT (I6)
222   FORMAT (2I6)
224   FORMAT (18I4)
226   FORMAT (9I4)
900   FORMAT ('1 CRASH VICTIM     ',5A6,3X,I2,' SEGMENTS',3X,
     &I2,' JOINTS',T124,'PAGE',I4)                                80386
902   FORMAT (T26,'PRINCIPAL MOMENTS OF INERTIA',T68,'SEGMENT',
     &' CONTACT ELLIPSIOD',T121,'CARDS B.2')
```

```
904  FORMAT (T4,'SEGMENT',T17,'WEIGHT',T32,'(',A12,')',T60,
    &'SEMIAXES (',A4,')',T87,'CENTER (',A4,')',
    &T111,'PRINCIPAL AXES (DEG)')
906  FORMAT ('  I  SYM PLOT   (',A4,')',T30,'X',T39,'Y',T48,
    &'Z',T59,'X',T67,'Y',T75,'Z',T85,'X',T93,'Y',T101,'Z',
    &T110,'YAW',T118,'PITCH',T128,'ROLL',/)
908  FORMAT (1X,I2,1X,A4,A3,F11.3,2X,3F9.4,2(2X,3F8.3),1X,3F9.2)
910  FORMAT ('-',T121,'CARDS B.3')
912  FORMAT ('   JOINT',T24,'LOCATION(',A4,') - SEG(JNT)   ',
    &'LOCATION(',A4,') - SEG(J+1)  PRIN. AXIS(DEG) - SEG',
    &'(JNT)  PRIN. AXIS(DEG) - SEG(J+1)')
914  FORMAT ('  J SYM PLOT PIN',T27,'X',T36,'Y',T45,'Z',T55,
    &'X',T64,'Y',T73,'Z',T82,'YAW',T90,'PITCH',T100,'ROLL',
    &T110,'YAW',T118,'PITCH',T128,'ROLL',/)
916  FORMAT (1X,I2,2A4,I5,I3,2(1X,3F9.3),2(1X,3F9.2))
918  FORMAT ('1 JOINT TORQUE CHARACTERISTICS',T124,'PAGE',
    &I4)
920  FORMAT (T24,'FLEXURAL SPRING CHARACTERISTICS',T83,
    &'TORSIONAL SPRING CHARACTERISTICS',/)
922  FORMAT (8X,2(7X,'SPRING COEF. (',2A4,'/DEG**J)',6X,
    &'ENERGY',5X,'JOINT'))
924  FORMAT ('  JOINT',2(9X,'LINEAR',4X,'QUADRATIC',5X,'CUBIC'
    &,4X,'DISSIPATION  STOP'))
926  FORMAT (8X,2(8X,'(J-1)',7X,'(J-2)',7X,'(J-3)',7X,'COEF.',
    &5X,'(DEG)'),/)
928  FORMAT (1X,I2,A4,2(3X,3F12.3,2F10.3))
929  FORMAT (10X,3F12.3,2F10.3)
930  FORMAT (T39,'JOINT VISCOUS CHARACTERISTICS AND LOCK-'
    &,'UNLOCK CONDITIONS',/)
932  FORMAT (T15,'VISCOUS',T31,'COULOMB',T45,'FULL FRICTION',
    &T63,'MAX TORQUE FOR',T81,'MIN TORQUE FOR',T99,'MIN. ',
    &'ANG. VELOCITY',T123,'IMPULSE')
934  FORMAT ('  JOINT',T13,'COEFFICIENT',T28,'FRICTION COEF. ',
    &'ANGULAR VELOCITY',T63,'A LOCKED JOINT',T81,'UNLOCKED ',
    &'JOINT',T121,'RESTITUTION')
936  FORMAT (T9,'(',2A4,' SEC/DEG)',T29,'(',2A4,')',T45,
    &'(DEG/ SEC)',T65,'(',2A4,')',T83,'(',2A4,')',T103,
    &'(RAD/ SEC)',T121,'COEFFICIENT',/)
938  FORMAT (1X,I2,A4,F14.3,2F15.2,4X,2F18.2,F20.2,F17.2)
939  FORMAT (7X,F14.3,2F15.2,4X,2F18.2,F20.2,F17.2)
940  FORMAT ('1',T6,'NPL',T13,'NBLT',T21,'NBAG',T29,'NELP',T39,
    &'NQ',T46,'NSD',T51,'NHRNSS',T59,'NWINDF',T68,'NJNTF',
    &T75,'NFORCE',T124,'PAGE',I4)
942  FORMAT (8(4X,'XXXX'),4X,I4,4X,'XXXX',T121,'CARD D.1')
944  FORMAT ('1',T124,'PAGE',I4)
946  FORMAT (' FUNCTION NO.',I4,T22,5A4,T121,'CARDS E.1',/)
948  FORMAT (T11,'D0',T26,'D1',T41,'D2',T56,'D3',T71,'D4')
950  FORMAT (1X,F14.4,4F15.4)
952  FORMAT ('-',T8,'FIRST PART OF FUNCTION - ',I4,' TABULAR ',
    &'POINTS',/)
954  FORMAT ('-',T8,'FIRST PART OF FUNCTION - 5TH DEGREE ',
    &'POLYNOMIAL',/)
```

```
956   FORMAT ('-',T8,'SECOND PART OF FUNCTION - ',I4,' TABULAR ',
     &'POINTS',/)
958   FORMAT ('-',T8,'SECOND PART OF FUNTION - 5TH DEGREE ',
     &'POLYNOMIAL',/)
960   FORMAT ('-',T8,'FUNCTION IS CONSTANT ',F11.6)
962   FORMAT (T9,'0',T26,'F(0)')
964   FORMAT (1X,F14.6,F15.4)
966   FORMAT (T9,'A0',T24,'A1',T39,'A2',T54,'A3',T69,'A4',T84,
     &'A5')
968   FORMAT (6E15.7)
970   FORMAT (5X,'JOINT FORCE FUNCTION NO. ',I4,T38,5A4,T121,
     &'CARD E.7'//)
972   FORMAT ('- FUNCTION IS TABULAR FOR ',I2,' X ',I2,' VALUES',
     &' OF THETA AND PHI',/)
974   FORMAT (T31,'THETA')
976   FORMAT (T6,'PHI',T14,'THETAO',F16.3,4F20.3/(15X,5F20.3))
978   FORMAT ('- FUNCTION IS COEFFICIENTS OF ',I2,' ORDER ',
     &'POLYNOMIALS IN (THETA-THETAO) FOR ',I2,' VALUES OF PHI')
980   FORMAT ('0',T28,'COEFFIECIENTS OF (THETA-THETAO)**N')
982   FORMAT (T6,'PHI',T14,'THETAO',7X,5(A4,'N =',I2,11X)/
     &(26X,A4,'N =',I2,11X,A4,'N =',I2,11X,A4,'N =',I2,11X,A4,
     &'N =',I2,11X,A4,'N =',I2)  )
984   FORMAT (F9.2,F10.3,5G20.7/(19X,5G20.7))
986   FORMAT ('1',122X,'PAGE ',I4/120X,'CARD F.5'/
     &        ' THE FOLLOWING JOINT RESTORING FORCE FUNCTIONS AS DEFINED
     & ON CARDS E.7 WILL BE USED.'//4X,'JOINT',10X,'FUNCTION'//)
988   FORMAT (I6,'-',A4,I10,'-',5A4)

      END
```

APPENDIX I

386-ATB Program Listing

```
      BLOCK DATA                                                        DECKA
C                                                REV IV    07/23/86TWOPI
      IMPLICIT REAL*8 (A-H,O-Z)                                         DECKA
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DECKA
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DECKA
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(   6),  DECKA
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), DECKA
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               DECKA
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           DECKA
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       DECKA
     *               JOINT(30),CGS(30),JS(30)                           DECKA
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      DECKA
      LOGICAL*1 CGS,JS                                                  DECKA
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         DECKA
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      COMMON/CDINT/ UU(4),GH(3,4),                                      DECKA
     *               E(3,240),FF(5,240),GG(5,240),Y(5,240),U(5,240),    DECKA
     *               H,HPRINT,TSAVE,TPRINT,TSTART,ICNT,IDBL,IFLAG,IDMMY 80386
      COMMON/DAMPER/ APSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)DECKA
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       DECKA
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          DECKA
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         DECKA
C     NOTE:  FF REPLACES F.                                             DECKA
      LOGICAL*1 FREE,LDMMY                                              80386
      COMMON/TEMPVS/ JTMPVS(24000),FREE(30),LDMMY(2),DMMY(23109)        80386
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DECKA
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DECKA
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DECKA
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DECKA
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)BUTLER2
      COMMON/VPOSTN/ ZPLT(3),SPLT(3),AXV(3,6),VATAB(6,501,6),           VEHICL
     *               VT0(6),VDT(6),TIMEV(6),OMEGV(6),NVTAB(6),INDXV(6)  DECKA
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DECKA
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          DECKA
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   DECKA
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),DECKA
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              DECKA
     *               KQ1(12),KQ2(12),KQTYPE(12)                         DECKA
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           DECKA
      COMMON/INTEST/ SGTEST(3,4,30),XTEST(3,120),SEGT(120),REGT(120)    DECKA
      REAL     SEGT                                                     DECKA
      COMMON/COMAIN/ VAR(240),DER(240),DT,H0,HMAX,HMIN,RSTIME,          DECKA
     *               ISTEP,NSTEPS,NDINT,NEQ,IRSIN,IRSOUT                DECKA
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 COMMON/ABDATA/ ZDEP(3,5),DBR(3,3,5),DPVCTR(3,5),DEPLOY(3,5),       DECKA
*               AB(3,5),B(9,4,5),ZR(3,4,5),BFB(3,4,5),DRR(9,4,5),   DECKA
*               VBAGG(5),VSCS(5),SPRK(5),CK(5),CMASS(5),CYMIN(5),   DECKA
*               CYMOUT(5),BAGPV(5),PD(5),VBAG(5),VOLBP(5),          DECKA
*               PCYV(5),PCYMIN(5),PVBAG(5),TV1(3,4,5),TV2(3,10,5),  DECKA
*               SWITCH(5),PYMOUT(5),SCALE(5),PREVT,IFULL(6)         DECKA
 COMMON/CYDATA/ CYTD(5),CYPA(5),CYSP(5),CYT0(5),CYV0(5),CYCD(5),    DECKA
*               CYK(5),CYR(5),CYAT(5),CYPV(5),CYCD0(5),CYA0(5),     DECKA
*               CYP0(5),CYSS(5),CYL0(5),CYC(5),CYRHO0(5),CYVMAX(5),DECKA
*               CYORFC(5),CYRHO(5),CYT(5),CYP(5),CYV(5)             DECKA
 COMMON/WINDFR/ WTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),     WINDOP
*               MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)        WINDOP
 END                                                                DECKA
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C                                                                       MAINA
C     AAMRL ARTICULATED TOTAL BODY (ATBIV) MODEL COMPUTER PROGRAM       ATBIV
C     DEVELOPED BY CALSPAN CORP. AND J&J TECHNOLOGIES INC.              BUTLER1
C                                                 REV IV    07/23/86TWOPI
C        80386 IMPLEMENTATION BY KETRON, INC.     - OCTOBER 31, 1989    80386
C     MAIN PROGRAM                                                      MAINA
C                                                                       MAINA
C     PERFORMS CARD INPUT, PROGRAM INITIALIZATION,                      MAINA
C     CONTROL OF INTEGRATION LOOP AND OPTIONAL OUTPUT.                  MAINA
C                                                                       MAINA
      IMPLICIT REAL*8(A-H,O-Z)                                          MAINA
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           MAINA
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           MAINA
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       MAINA
     *               JOINT(30),CGS(30),JS(30)                           MAINA
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      MAINA
      LOGICAL*1 CGS,JS                                                  MAINA
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         MAINA
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/COMAIN/ VAR(240),DER(240),DT,HO,HMAX,HMIN,RSTIME,          MAINA
     *               ISTEP,NSTEPS,NDINT,NEQ,IRSIN,IRSOUT                MAINA
      LOGICAL NPRT1,NPRT2,NPRT3                                         MAINA
      COMMON/DEVICE/ IDEF,IOPORT,MODEL                                  80386
      CHARACTER*12 FILE1,FILE2,FILE3,FILE4,FILE5,FILE6,FILE8,FILE20     80386
      CHARACTER*1 CHR                                                   80386
      CALL ELTIME(1, 1)                                                 MAINA
C                                                                       PECONV
C     MAKE THE OUTPUT FILES PRINTER CONTROL FILES FOR THE P&E           PECONV
C                                                                       PECONV
      OPEN (UNIT=14,FILE='ATBIV.DIR',STATUS='OLD')                      80386
      READ (14,'(6(A12/),A12)')FILE1,FILE2,FILE3,FILE4,FILE5,FILE6,FILE880386
      READ (14,'(2(I4/),I4)')IDEF,IOPORT,MODEL                          80386
      OPEN (UNIT=5,FILE=FILE5,STATUS='OLD')                             80386
      OPEN (UNIT=6,FILE=FILE6,STATUS='NEW',CARRIAGE CONTROL='FORTRAN')  80386
C     CALL CARCON(6,1)                                                  80386
C     CALL CARCON(2,1)                                                  80386
C                                                                       MAINA
C     WRITE PROLOGUE ON PRIMARY OUTPUT UNIT.                            MAINA
C                                                                       MAINA
      NPG=2                                                             PAGE
      WRITE(6,11)                                                       MAINA
   11 FORMAT(1H1,30X,'AAMRL ARTICULATED TOTAL BODY (ATB) MODEL',52X,    ATBIV
     *      'PAGE    1'////                                             PAGE
     * 31X,'DEVELOPED BY CALSPAN CORP., P.O. BOX 400, BUFFALO NY 14225'/BUTLER1
     * 31X,'AND BY J&J TECHNOLOGIES INC., ORCHARD PARK, NY 14127'    // EDGE
     * 31X,'FOR THE AIR FORCE ARMSTRONG AEROSPACE MEDICAL RESEARCH  ' / VEHICL
     * 31X,'LABORATORY, WRIGHT PATTERSON AIR FORCE BASE          '    /ATBIV
     * 31X,'UNDER CONTRACTS F33615-75C-5002,-78C-0516 AND -80C-05117' //BUTLER1
     * 31X,'AND FOR THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION,'BUTLER1
     */31X,'U.S. DEPARTMENT OF TRANSPORTATION, UNDER CONTRACTS'   /     BUTLER1
     * 31X,'FH-11-7592, HS-053-2-485, HS-6-01300 AND HS-6-01410.' ////  BUTLER1
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     * 31X,'PROGRAM DOCUMENTATION: NHTSA REPORT NOS. DOT-HS-801-507' /  BUTLER1
     * 31X,'THROUGH 510 (FORMERLY CALSPAN REPORT NO. ZQ-5180-L-1),' /   BUTLER1
     * 31X,'AVAILABLE FROM NTIS (ACCESSION NOS. PB-241692,3,4 AND 5),' /BUTLER1
     * 31X,'APPENDIXES A-J TO THE ABOVE (AVAILABLE FROM CALSPAN),' /    BUTLER1
     * 31X,'AND REPORT NOS. AMRL-TR-75-14 (NTIS NO. AD-A014 816),'/     ATBIV
     * 31X,'AFAMRL-TR-80-14 (NTIS NO. AD-A088 029), AND'/               ATBIV
     * 31X,'AFAMRL-TR-83-073 (NTIS NO. AD-B079 184).'////
     * 31X,'PROGRAM ATB-IV 80386 IMPLEMENTATION COMPLETED BY KETRON,'/  80386
     * 31X,'OCTOBER 31, 1989, UNDER CONTRACT F33615-88-C-0543'////)     80386
C    * 31X,'PROGRAM ATB-IV, EXECUTED ON THE AAMRL/BB CONCURRENT'/       80386
C    * 31X,'3250 COMPUTER, WRIGHT-PATTERSON AFB, OHIO'////)             80386
C                                                                      MAINA
C     INPUT CARDS A.1 AND A.2, TEST FOR RESTART.                       MAINA
C                                                                      MAINA
      CALL BLKDTA                                                      MAINA
      READ(5,12)  DATE,IRSIN,IRSOUT,RSTIME,COMENT                      MAINA
   12 FORMAT(3A4,2I4,F8.0/20A4/20A4)                                   MAINA
      WRITE(6,13)  DATE,IRSIN,IRSOUT,RSTIME,COMENT                     MAINA
   13 FORMAT(/////4X,3A4,'  IRSIN=',I4,'  IRSOUT=',I4,'  RSTIME =',F8.4,MAINA
     *       61X,'CARDS A'//1X,20A4/1X,20A4//)                         MAINA
      IF (IRSIN.NE.0)                                                  80386
     *   OPEN (UNIT=4,FILE=FILE4,STATUS='OLD',FORM='UNFORMATTED')      80386
      IF (IRSOUT.NE.0)                                                 80386
     *   OPEN (UNIT=3,FILE=FILE3,STATUS='NEW',FORM='UNFORMATTED')      80386
      IF (IRSIN.NE.0) GO TO 18                                         MAINA
C                                                                      MAINA
C     INPUT CARDS A.3,A.4 AND A.5.                                     MAINA
C                                                                      MAINA
      READ(5,14)  UNITL,UNITM,UNITT,GRAVTY,G                           MAINA
   14 FORMAT(3A4,4F12.0)                                               MAINA
      IF  (G.EQ.0.0)  G = DSQRT(GRAVTY(1)**2+GRAVTY(2)**2+GRAVTY(3)**2) MAINA
      READ(5,15)  NDINT,NSTEPS,DT,HO,HMAX,HMIN,NPRT                    MAINA
   15 FORMAT(2I4,4F8.0/36I2)                                           MAINA
      WRITE(6,16)  UNITL,UNITM,UNITT,GRAVTY,G,                         CHGIII
     *             NDINT,NSTEPS,DT,HO,HMAX,HMIN                        MAINA
   16 FORMAT(5X,'UNITL = ',A4,5X,'UNITM = ',A4,5X,'UNITT = ',A4,       CHGIII
     *       5X,'GRAVITY VECTOR = (',F9.4,',',F9.4,',',F9.4,')',5X,'G ='CHGIII
     *F9.4,//,5X,'NDINT =',I4,5X,'NSTEPS =',I5,5X,'DT =',F8.6,          MAINA
     *       5X,'HO =',F8.6,5X,'HMAX =',F8.6,5X,'HMIN =',F8.6)         MAINA
      WRITE(6,17)  (I,I=1,36),NPRT                                     MAINA
   17 FORMAT('0 NPRT ARRAY'/3X,36I3/3X,36I3)                           MAINA
      NPRT4 = NPRT(4)                                                  MAINA
      IF(NPRT(26).GT.6) STOP 93                                        TGMOD1
      IF  (NPRT(4).NE.0)                                               80386
     *   OPEN (UNIT=8,FILE=FILE8,STATUS='NEW',FORM='UNFORMATTED')      80386
      IF  (NPRT(4).LT.0)  GO TO 50                                     MAINA
      IF  (NPRT(4).EQ.0.OR.NPRT(4).EQ.1.OR.NPRT(4).EQ.4) THEN          80386
         READ (14,'(A12)',END=38)FILE20                                80386
         IDOT=INDEX(FILE20,'.')                                        80386
         IF(IDOT.LT.2.OR.IDOT.GT.9)GO TO 38                            80386
         CHR=FILE20(IDOT+2:IDOT+2)                                     80386
         IF(LLT(CHR,'0').OR.LGT(CHR,'9'))GO TO 38                      80386
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          CHR=FILE20(IDOT+3:IDOT+3)                                     80386
          IF(LLT(CHR,'0').OR.LGT(CHR,'9'))GO TO 38                      80386
          READ(FILE20(IDOT+2:IDOT+3),'(I2)')IMULT                       80386
          IF(IMULT.LT.21.OR.IMULT.GT.85)GO TO 38                        80386
          DO 37 II=21,IMULT                                             80386
             WRITE(FILE20(IDOT+2:IDOT+3),'(I2)')II                      80386
             OPEN (UNIT=II,FILE=FILE20,STATUS='NEW',                    80386
     *             CARRIAGE CONTROL='FORTRAN')                          80386
   37     CONTINUE                                                      80386
       ENDIF                                                            80386
   38 CONTINUE                                                          80386
       IF  (NPRT(1).NE.0)                                               80386
     *    OPEN (UNIT=1,FILE=FILE1,STATUS='NEW',FORM='UNFORMATTED')      80386
       IF  (NPRT(5).NE.0.OR.NPRT(6).NE.0.OR.NPRT(7).NE.0)               80386
     * OPEN (UNIT=2,FILE=FILE2,STATUS='NEW',CARRIAGE CONTROL='FORTRAN') 80386
C                                                                       MAINA
C     CALL INPUT ROUTINES                                               MAINA
C                                                                       MAINA
      CALL BINPUT                                                       MAINA
      CALL VINPUT                                                       MAINA
      CALL SINPUT                                                       MAINA
      CALL CINPUT                                                       MAINA
C                                                                       MAINA
C     PROGRAM INITIALIZATION                                            MAINA
C                                                                       MAINA
      TIME = 0.0                                                        MAINA
      CALL INITAL                                                       MAINA
      GO TO 19                                                          MAINA
C                                                                       MAINA
C     READ INPUT DATA FROM RESTART TAPE AND WRITE NEW TAPE.             MAINA
C     THE FIVE FUNCTIONS OF SUBROUTINE RSTART ARE:                      MAINA
C        1. READ INPUT & INITIALIZATION RECORD FROM OLD RESTART TAPE.   MAINA
C        2. WRITE INPUT & INITIALIZATION RECORD ONTO NEW RESTART TAPE.  MAINA
C        3. READ TIME POINT RECORD FROM OLD RESTART TAPE.               MAINA
C        4. READ NEW INPUT DATA FROM INPUT STREAM FOR RESTART.          MAINA
C        5. WRITE TIME POINT RECORD ONTO NEW RESTART TAPE.              MAINA
C                                                                       MAINA
   18 CALL RSTART(1,IRSIN)                                              MAINA
      CALL RSTART(4,5)                                                  MAINA
      NPRT4 = NPRT(4)                                                   MAINA
   19 IF (IRSOUT.NE.0) CALL RSTART(2,IRSOUT)                            MAINA
C                                                                       MAINA
C     INTEGRATION LOOP - ADVANCE TIME BY EITHER INTEGRATING THROUGH     MAINA
C     SUBROUTINE DINT OR BY FETCHING TIME POINT RECORD FROM RESTART TAPEMAINA
C                                                                       MAINA
      TIME = 0.0                                                        MAINA
      ISTEP = 0                                                         MAINA
   20 IF (IRSIN.EQ.0) GO TO 23                                          MAINA
      IF (TIME.GT.RSTIME+0 5*DT) GO TO 23                               MAINA
      IF (DABS(TIME-RSTIME).LT.0.5*DT) GO TO 21                         MAINA
      CALL RSTART(3,IRSIN)                                              MAINA
      GO TO 24                                                          MAINA
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```
   21 CALL RSTART(4,5)                                                   MAINA
      IF  (NPRT(4).LT.0)  GO TO 50                                       MAINA
   23 CALL DINT                                                          MAINA
C                                                                        MAINA
C     OPTIONAL OUTPUT                                                    MAINA
C     1. PRINTER PLOT ON OUTPUT UNIT 2 CONTROLLED BY NPRT(5) & (6).      MAINA
C                                                                        MAINA
   24 CALL PRIPLT                                                        MAINA
C                                                                        MAINA
C     2. RESTART DATA ON UNIT IRSOUT CONTROLLED BY IRSOUT # 0.           MAINA
C                                                                        MAINA
      IF (IRSOUT.NE.0) CALL RSTART(5,IRSOUT)                             MAINA
C                                                                        MAINA
C     3. SUBROUTINE PRINT ON PRIMARY OUTPUT UNIT CONTROLLED BE NPRT(3).  MAINA
C                                                                        MAINA
      NPRT3 = (NPRT(3).EQ.1)                                             MAINA
      IF (NPRT(3).GT.1) NPRT3 = (MOD(ISTEP,NPRT(3)).EQ.0)                MAINA
      IF (NPRT3) CALL PRINT(6HMAIN3D)                                    MAINA
C                                                                        MAINA
C     4. PROGRAM VIEW PLOT DATA ON UNIT 1 CONTROLLED BY NPRT(1).         MAINA
C                                                                        MAINA
      NPRT1 = (NPRT(1).EQ.1)                                             MAINA
      IF (NPRT(1).GT.1) NPRT1 = (MOD(ISTEP,NPRT(1)).EQ.0)                MAINA
      IF  (NPRT1)  CALL UNIT1(0)                                         MAINA
C                                                                        MAINA
C     5. SUBROUTINE ELTIME ON PRIMARY OUTPUT UNIT CONTROLLED BY NPRT(2).MAINA
C                                                                        MAINA
      NPRT2 = (NPRT(2).EQ.1)                                             MAINA
      IF (NPRT(2).GT.1) NPRT2 = (MOD(ISTEP,NPRT(2)).EQ.0)                MAINA
      IF (NPRT2) CALL ELTIME(NPG,1)                                      PAGE
C                                                                        MAINA
C     END OF INTEGRATION LOOP.                                           MAINA
C                                                                        MAINA
      ISTEP = ISTEP+1                                                    MAINA
      IF (ISTEP.LE.NSTEPS) GO TO 20                                      MAINA
C                                                                        MAINA
C     6. SUBROUTINE POSTPR ON PRIMARY OUTPUT UNIT CONTROLLED BY NPRT(4).MAINA
C                                                                        MAINA
   50 IF  (NPRT4 GT.0)  END FILE 8                                       MAINA
      IF  (NPRT(4).EQ.0 .OR. NPRT(4).EQ.4)  GO TO 60                     MAINA
      PRDT = 1000.0*DT                                                   MAINA
      CALL POSTPR (PRDT)                                                 MAINA
      IF  (NPRT2)  CALL ELTIME(NPG,1)                                    PAGE
C                                                                        MAINA
C     7. END OF RUN - CALL ELTIME IF NOT CALLED ABOVE.                   MAINA
C                                                                        MAINA
   60 IF  (.NOT.NPRT2)  CALL ELTIME(NPG,1)                               PAGE
      STOP  1                                                            MAINA
      END                                                                MAINA
```

```
      SUBROUTINE ADJUST (M,D1)                                          ADJUST
C                                                      REV IV    07/23/86TWOPI
      IMPLICIT REAL*8 (A-H,O-Z)                                         ADJUST
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         ADJUST
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/CDINT/ UU(4),GH(3,4),                                      ADJUST
     *              E(3,240), F(5,240),GG(5,240),Y(5,240),U(5,240),     ADJUST
     *              H,HPRINT,HS,TPRINT,TSTART,ICNT,IDBL,IFLAG,IDMMY     80386
      COMMON/COMAIN/ VAR(240),DER(240),DT,H0,HMAX,HMIN,RSTIME,          ADJUST
     *               ISTEP,NSTEPS,NDINT,NEQ,IRSIN,IRSOUT                ADJUST
      IF  (M.NE.1)  GO TO 12                                            ADJUST
C                                                                       ADJUST
C     M = 1:                                                            ADJUST
C                                                                       ADJUST
      DO  11  I=1,NEQ                                                   ADJUST
      W = VAR(I) - GG(1,I)                                              ADJUST
      Z = DER(I) - GG(2,I)                                              ADJUST
      ZZ = Z - GG(5,I)*W - GG(3,I)*UU(3) - GG(4,I)*UU(4)                ADJUST
      GG(3,I) = GG(3,I) + ZZ*UU(1)                                      ADJUST
      GG(4,I) = GG(4,I) + ZZ*UU(2)                                      ADJUST
      Y(1,I) = VAR(I)                                                   ADJUST
   11 Y(2,I) = DER(I)                                                   ADJUST
      GO TO 99                                                          ADJUST
   12 IF  (M.EQ.3)  GO TO 23                                            ADJUST
C                                                                       ADJUST
C     M = 2,4,5:                                                        ADJUST
C                                                                       ADJUST
      H1 = EPS(1)/H                                                     ADJUST
      N2 = NEQ/2                                                        ADJUST
      DO  20  I=1,NEQ,3                                                 ADJUST
      ZA = 0.0                                                          ADJUST
      IF  (I.LE.N2)  GO TO 20                                           ADJUST
      IF  (M.EQ.4)   GO TO 16                                           ADJUST
      VARX = VAR(I  ) - Y(1,I  )                                        ADJUST
      VARY = VAR(I+1) - Y(1,I+1)                                        ADJUST
      VARZ = VAR(I+2) - Y(1,I+2)                                        ADJUST
      DERX = DER(I  ) - Y(2,I  )                                        ADJUST
      DERY = DER(I+1) - Y(2,I+1)                                        ADJUST
      DERZ = DER(I+2) - Y(2,I+2)                                        ADJUST
      GO TO 17                                                          ADJUST
   16 VARX = VAR(I  ) - U(1,I  )                                        ADJUST
      VARY = VAR(I+1) - U(1,I+1)                                        ADJUST
      VARZ = VAR(I+2) - U(1,I+2)                                        ADJUST
      DERX = DER(I  ) - U(2,I  )                                        ADJUST
      DERY = DER(I+1) - U(2,I+1)                                        ADJUST
      DERZ = DER(I+2) - U(2,I+2)                                        ADJUST
   17 U(3,I) = U(3,I) + VARX*DERX + VARY*DERY + VARZ*DERZ               ADJUST
      U(4,I) = U(4,I) + VARX**2 + VARY**2 + VARZ**2                     ADJUST
      IF (U(4,I).EQ.0.0) GO TO 18                                       FIXADJ
      ZA = H1                                                           FIXADJ
      IF (U(3,I).LT.H1*U(4,I))  ZA = U(3,I)/U(4,I)                      FIXADJ
   18 GG(5,I+2) = ZA                                                    FIXADJ
```

```
      GG(5,I+1) = ZA                                                    ADJUST
   20 GG(5,I  ) = ZA                                                    ADJUST
      GO TO (99,21,99,23,25),M                                          ADJUST
C                                                                       ADJUST
C     M = 2:                                                            ADJUST
C                                                                       ADJUST
   21 DO  22  I=1,NEQ                                                   ADJUST
      ZA = GG(5,I)                                                      ADJUST
      Y1 = Y(4,I)  - ZA*Y(3,I)                                          ADJUST
      Y2 = GG(2,I) - ZA*GG(1,I)                                         ADJUST
      Y3 = DER(I)  - ZA*VAR(I)                                          ADJUST
      GG(3,I) = -Y1*GH(1,1) + Y2*GH(2,1) + Y3*GH(3,1)                   ADJUST
      GG(4,I) =  Y1*GH(1,2) - Y2*GH(2,2) + Y3*GH(3,2)                   ADJUST
      Y(1,I) = 0.5*(Y(1,I)+VAR(I))                                      ADJUST
   22 Y(2,I) = 0.5*(Y(2,I)+DER(I))                                      ADJUST
      GO TO 99                                                          ADJUST
C                                                                       ADJUST
C     M = 3,4:                                                          ADJUST
C                                                                       ADJUST
   23 DO  24  I=1,NEQ                                                   ADJUST
      ZA = GG(5,I)                                                      ADJUST
      Y1 = GG(2,I) - ZA*GG(1,I)                                         ADJUST
      Y2 = Y(2,I)  - ZA*Y(1,I)                                          ADJUST
      Y3 = DER(I)  - ZA*VAR(I)                                          ADJUST
      GG(3,I) = -Y1*GH(1,3) + Y2*GH(2,3) - Y3*GH(3,3)                   ADJUST
      GG(4,I) =  Y1*GH(1,4) - Y2*GH(2,4) + Y3*GH(3,4)                   ADJUST
      U(1,I) = VAR(I)                                                   ADJUST
   24 U(2,I) = DER(I)                                                   ADJUST
      GO TO 99                                                          ADJUST
C                                                                       ADJUST
C     M = 5:                                                            ADJUST
C                                                                       ADJUST
   25 DO  26  I=1,NEQ                                                   ADJUST
      ZA = GG(5,I)                                                      ADJUST
      Y1 = GG(2,I) - ZA*GG(1,I)                                         ADJUST
      Y2 = DER(I)  - ZA*VAR(I)                                          ADJUST
      Y3 = U(2,I)  - ZA*U(1,I)                                          ADJUST
      GG(3,I) = -Y1*GH(1,3) + Y2*GH(2,3) - Y3*GH(3,3)                   ADJUST
      GG(4,I) =  Y1*GH(1,4) - Y2*GH(2,4) + Y3*GH(3,4)                   ADJUST
      Y(1,I) = VAR(I)                                                   ADJUST
   26 Y(2,I) = DER(I)                                                   ADJUST
   99 RETURN                                                            ADJUST
      END                                                               ADJUST
```

```
      SUBROUTINE  AIRBAG                                                AIRBAG
C                                                 REV IV    07/24/86SLIP
C     AIRBAG ROUTINE CALLED BY SUBROUTINE CONTCT TO DETERMINE THE INTER-AIRBAG
C     ACTION OF THE BAG WITH REACTION PANELS AND BODY SEGMENTS BY USE OFAIRBAG
C     SUBROUTINE BGG. THE DIFFERENTIAL PRESSURE,FORCE AND TORQUE ON THE AIRBAG
C     BAG IS EVALUATED AND THE RESULTING FORCE AND TORQUE ON THE BODY   AIRBAG
C     SEGMENTS ARE ADDED TO THE U1 AND U2 ARRAYS.                       AIRBAG
C                                                                       AIRBAG
      IMPLICIT REAL*8 (A-H,O-Z)                                         AIRBAG
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           AIRBAG
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),AIRBAG
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       AIRBAG
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     AIRBAG
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    AIRBAG
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), AIRBAG
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), AIRBAG
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               AIRBAG
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         AIRBAG
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         AIRBAG
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/ABDATA/ ZDEP(3,5),DBR(3,3,5),DPVCTR(3,5),DEPLOY(3,5),      AIRBAG
     *               AB(3,5),B(9,4,5),ZR(3,4,5),BFB(3,4,5),DRR(9,4,5),  AIRBAG
     *               VBAGG(5),VSCS(5),SPRK(5),CK(5),CMASS(5),CYMIN(5),  AIRBAG
     *               CYMOUT(5),BAGPV(5),PD(5),VBAG(5),VOLBP(5),         AIRBAG
     *               PCYV(5),PCYMIN(5),PVBAG(5),TV1(3,4,5),TV2(3,10,5), AIRBAG
     *               SWITCH(5),PYMOUT(5),SCALE(5),PREVT,IFULL(6)        AIRBAG
      COMMON/CYDATA/ CYTD(5),CYPA(5),CYSP(5),CYT0(5),CYV0(5),CYCD(5),   AIRBAG
     *               CYK(5),CYR(5),CYAT(5),CYPV(5),CYCD0(5),CYA0(5),    AIRBAG
     *               CYP0(5),CYSS(5),CYL0(5),CYC(5),CYRHO0(5),CYVMAX(5),AIRBAG
     *               CYORFC(5),CYRHO(5),CYT(5),CYP(5),CYV(5)            AIRBAG
      COMMON/TEMPVS/ TMP(9),TMP1(3),TORQ(3),FORCE(3,5),TORA(3,5),       AIRBAG
     *           TQB(3,10),FRB(3,10),VOL(10),DELF(3),VOLP(4,5),FRA(4,5)AIRBAG
     *           ,DMMY(34955)                                           80386
C     NOTE: THIS COMMON/TEMPVS/ IS SHARED BY AIRBAG AND AIRBGG.         AIRBAG
      CALL ELTIME(1,24)                                                 AIRBAG
      DELT = TIME-PREVT                                                 AIRBAG
      NBGSF = 0                                                         AIRBAG
      DO  70  J=1,NBAG                                                  AIRBAG
      IF  (MNBAG(J).EQ.0)  GO TO 70                                     AIRBAG
      IF  (IFULL(J).LE.0)  GO TO 69                                     AIRBAG
      CALL AIRBGG(J)                                                    AIRBAG
C                                                                       AIRBAG
C     COMPUTE  CMOUT: MASS FLOW OUT OF BAG                              AIRBAG
C              BAGPV: UNDISTORTED BAG VOLUME                            AIRBAG
C                                                                       AIRBAG
      IF  (PD(J).GT.CYPV(J))  CYMOUT(J) = PYMOUT(J)                     AIRBAG
     *                        + DELT*CYORFC(J)*DSQRT(PD(J))             AIRBAG
      BAGPV(J) = CYPA(J)*((CYMIN(J)-CYMOUT(J))*SWITCH(J))**CYK(J)       AIRBAG
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C                                                                        AIRBAG
C     BAG IS FULLY INFLATED, COMPUTE DIFFERENTIAL PRESSURE               AIRBAG
C                                                                        AIRBAG
      PD(J) - BAGPV(J)/(VBAG(J)-VOLBP(J))**CYK(J) - CYPA(J)              AIRBAG
      JB - NVEH + J                                                      AIRBAG
      KP - NPANEL(J)                                                     AIRBAG
      KBAG - MNBAG(J)                                                    AIRBAG
C                                                                        AIRBAG
C     OPTIONAL DIAGNOSTIC OUTPUT                                         AIRBAG
C                                                                        AIRBAG
      IF  (NPRT(21).NE.0)  WRITE(6,41)                                   AIRBAG
     *  ((FRB(I,K),I-1,3),(TQB(I,K),I-1,3),K-1,KBAG),(FORCE(I,J),I-1,3),AIRBAG
     *  (TORA(I,J),I-1,3),TORQ,((FRA(I,K),I-1,3),VOLP(K,J),K-1,KP),      AIRBAG
     *  (VOL(K),K-1,KBAG),VOLBP(J),CYMOUT(J),BAGPV(J),PD(J)              AIRBAG
   41 FORMAT ('OAIRBAG CONTCT'/(1X,9G14.6))                              AIRBAG
      IF  (PD(J).LT.0.0)  PD(J) - 0.0                                    AIRBAG
      IF  (PD(J).EQ.0.0)  GO TO 46                                       AIRBAG
C                                                                        AIRBAG
C     SET UP BAGSF ARRAY FOR OUTPUT ROUTINE                              AIRBAG
C                                                                        AIRBAG
      KBGSF - NBGSF+5                                                    AIRBAG
      DO  42  K-1,KP                                                     AIRBAG
      KBGSF - KBGSF+1                                                    AIRBAG
      DO  42  I-1,3                                                      AIRBAG
   42 BAGSF(I,KBGSF) - PD(J)*FRA(I,K)                                    AIRBAG
      DO  45  I-1,KBAG                                                   AIRBAG
      KBGSF - KBGSF+1                                                    AIRBAG
      IF  (VOL(I).EQ.0.0)  GO TO 45                                      AIRBAG
      M - MBAG(2,I,J)                                                    AIRBAG
C                                                                        AIRBAG
C     FINAL COMPUTATIONS OF FORCE AND TORQUE ON AIRBAG                   AIRBAG
C                                                                        AIRBAG
      DO  44  K-1,3                                                      AIRBAG
      FRB(K,I) - PD(J)*FRB(K,I)                                          AIRBAG
      BAGSF(K,KBGSF) - FRB(K,I)                                          AIRBAG
      U1(K,M) - U1(K,M) - FRB(K,I)                                       AIRBAG
   44 U2(K,M) - U2(K,M) + PD(J)*TQB(K,I)                                 AIRBAG
   45 CONTINUE                                                           AIRBAG
   46 DO  47  K-1,3                                                      AIRBAG
      FORCE(K,J) - PD(J)*FORCE(K,J)                                      AIRBAG
   47 TORA (K,J) - PD(J)*TORA (K,J)                                      AIRBAG
      IF  (VOLP(1,J).NE.0.0)  GO TO 55                                   AIRBAG
C                                                                        AIRBAG
C     AIRBAG IS NOT INTERSECTING PRIMARY REACTION PANEL.                 AIRBAG
C     COMPUTE ARTIFICIAL FORCE AND TORQUE WITH A LINEAR SPRING FUNCTION AIRBAG
C     IN AN ATTEMPT TO TIE +X SEMIAXIS ENDPOINT OF AIRBAG TO DEPLOYMENT AIRBAG
C     POINT ON REACTION PANEL.                                           AIRBAG
C                                                                        AIRBAG
      DO  51  K-1,3                                                      AIRBAG
   51 TMP(K) - BFB(K,1,J) + ZDEP(K,J)                                    AIRBAG
      CALL DOT31 (D(1,1,NVEH),TMP,TMP1)                                  AIRBAG
      DO  52  K-1,3                                                      AIRBAG
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      DELF(K) = TMP1(K) + SEGLP(K,NVEH) - SEGLP(K,JB)                AIRBAG
   52 TMP(K) = BD(K+3,JB)                                             AIRBAG
      TMP(1) = TMP(1) + BD(1,JB)                                      AIRBAG
      CALL DOT31 (D(1,1,JB),TMP,TMP1)                                 AIRBAG
      DO  53  K=1,3                                                   AIRBAG
      DELF(K) = SPRK(J)*(DELF(K)-TMP1(K))                             AIRBAG
      BAGSF(K,NBGSF+5) = DELF(K)                                      AIRBAG
   53 FORCE(K,J) = FORCE(K,J) + DELF(K)                               AIRBAG
      CALL MAT31 (D(1,1,JB),DELF,TMP1)                                AIRBAG
      CALL CROSS (TMP,TMP1,DELF)                                      AIRBAG
      DO  54  K=1,3                                                   AIRBAG
   54 TORA(K,J) = TORA(K,J) + DELF(K)                                 AIRBAG
   55 XDD = CYMIN(J) - CYMOUT(J) + W(JB)                              AIRBAG
      FMASS = CMASS(J)*XDD/G                                          AIRBAG
      TMASS = CMASS(J)*(XDD+W(JB)*2.0/3.0)/G                          AIRBAG
      DO  56  I=1,3                                                   AIRBAG
   56 TMP(I) = WMEG(I,JB)*PHI(I,JB)                                   AIRBAG
      CALL CROSS (WMEG(1,JB),TMP,TMP1)                                AIRBAG
      DO  57  I=1,3                                                   AIRBAG
      SEGLA(I,JB) = FORCE(I,J)/FMASS + GRAVTY(I)                      AIRBAG
   57 WMEGD(I,JB) = (TORA(I,J)/TMASS-TMP1(I))*RPHI(I,JB)              AIRBAG
   69 NBGSF = NBGSF + 5 + NPANEL(J) + MNBAG(J)                        AIRBAG
   70 CONTINUE                                                        AIRBAG
      CALL ELTIME(2,24)                                               AIRBAG
      RETURN                                                          AIRBAG
      END                                                             AIRBAG
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      SUBROUTINE AIRBGG(J)                                              AIRBGG
C                                                   REV III.5 10/17/85EDGE
C     CALLED BY SUBROUTINES AIRBAG AND AIRBG3 TO COMPUTE VOLUMES OF     AIRBGG
C     INTERSECTION BETWEEN AIRBAGS AND PANELS AND SEGMENTS.             AIRBGG
C                                                                       AIRBGG
      IMPLICIT REAL*8 (A-H,O-Z)                                         AIRBGG
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           AIRBGG
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),AIRBGG
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       AIRBGG
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), AIRBGG
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), AIRBGG
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               AIRBGG
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         AIRBGG
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/ABDATA/ ZDEP(3,5),DBR(3,3,5),DPVCTR(3,5),DEPLOY(3,5),      AIRBGG
     *               AB(3,5),B(9,4,5),ZR(3,4,5),BFB(3,4,5),DRR(9,4,5),  AIRBGG
     *               VBAGG(5),VSCS(5),SPRK(5),CK(5),CMASS(5),CYMIN(5),  AIRBGG
     *               CYMOUT(5),BAGPV(5),PD(5),VBAG(5),VOLBP(5),         AIRBGG
     *               PCYV(5),PCYMIN(5),PVBAG(5),TV1(3,4,5),TV2(3,10,5), AIRBGG
     *               SWITCH(5),PYMOUT(5),SCALE(5),PREVT,IFULL(6)        AIRBGG
      COMMON/CYDATA/ CYTD(5),CYPA(5),CYSP(5),CYT0(5),CYV0(5),CYCD(5),   AIRBGG
     *               CYK(5),CYR(5),CYAT(5),CYPV(5),CYCD0(5),CYA0(5),    AIRBGG
     *               CYP0(5),CYSS(5),CYL0(5),CYC(5),CYRHO0(5),CYVMAX(5),AIRBGG
     *               CYORFC(5),CYRHO(5),CYT(5),CYP(5),CYV(5)            AIRBGG
      COMMON/TEMPVS/ TMP(9),TMP1(3),TORQ(3),FORCE(3,5),TORA(3,5),       AIRBGG
     *           TQB(3,10),FRB(3,10),VOL(10),DELF(3),VOLP(4,5),FRA(4,5)AIRBGG
     *           ,DMMY(34955)                                           80386
C     NOTE: THIS COMMON/TEMPVS/ IS SHARED BY AIRBAG AND AIRBGG.         AIRBGG
      JB = NVEH + J                                                     AIRBGG
      VOLBP(J) = 0.0                                                    AIRBGG
C                                                                       AIRBGG
C     COMPUTE THERMODYNAMIC PROPERTIES OF AIRBAG                        AIRBGG
C         CYRHO  : DENSITY                                              AIRBGG
C         CYT    : TEMPERATURE                                          AIRBGG
C         CYP    : PRESSURE                                             AIRBGG
C         CYMIN  : MASS FLOW INTO BAG                                   AIRBGG
C         VBCALC : CALCULATED VOLUME                                    AIRBGG
C                                                                       AIRBGG
      Q  = 1.0                                                          AIRBGG
      Q1 = 1.0                                                          AIRBGG
      Q2 = 1.0                                                          AIRBGG
      IF  (TIME.LE.CYTD(J))  GO TO 13                                   AIRBGG
      Q  = 1.0 + CYC(J)*(TIME-CYTD(J))                                  AIRBGG
      CYK1 = 2.0/(CYK(J)-1.0)                                           AIRBGG
      Q1 = 1.0/Q**CYK1                                                  AIRBGG
      Q2 = 1.0/Q**(CYK(J)*CYK1)                                         AIRBGG
   13 CYRHO(J) = CYRHO0(J)*Q1                                           AIRBGG
      CYT(J)   = CYT0(J)/Q**2                                           AIRBGG
      CYP(J)   = CYP0(J)*Q2                                             AIRBGG
      CYMIN(J) = CYV0(J)*(CYRHO0(J)-CYRHO(J))                           AIRBGG
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      CYV(J)    = CYVMAX(J)*(1.0-Q2)                                    AIRBGG
      IF  (TIME.LT.CYTD(J))  GO TO 31                                   AIRBGG
      IF  (BD(1,JB).EQ.0.0)  GO TO 31                                   AIRBGG
      IF  (TIME.LE.0.0)      GO TO 31                                   AIRBGG
      VOLB = 0.0                                                        AIRBGG
C                                                                       AIRBGG
C     COMPUTE AIRBAG ELLIPSOID MATRIX AND ZERO BAG FORCE AND TORQUE.    AIRBGG
C                                                                       AIRBGG
      IF  (IFULL(J).NE.0)  GO TO 21                                     AIRBGG
      SAB = SCALE(J)*AB(1,J)                                            AIRBGG
      DO  19  I=1,3                                                     AIRBGG
   19 TMP(I) = DEPLOY(I,J) + SAB*DPVCTR(I,J)                            AIRBGG
      CALL DOT31 (D(1,1,NVEH),TMP,SEGLP(1,JB))                          AIRBGG
      DO  20  I=1,3                                                     AIRBGG
   20 SEGLP(I,JB) = SEGLP(I,JB) + SEGLP(I,NVEH)                         AIRBGG
   21 DO  23  I=1,3                                                     AIRBGG
      FORCE(I,J) = 0.0                                                  AIRBGG
   23 TORA (I,J) = 0.0                                                  AIRBGG
C                                                                       AIRBGG
C     COMPUTE FORCE,TORQUE AND VOLUME OF INTERSECTION                   AIRBGG
C     OF AIRBAG WITH REACTION PANEL ELLIPSOIDS.                         AIRBGG
C                                                                       AIRBGG
      KP = NPANEL(J)                                                    AIRBGG
      DO  26  K=1,KP                                                    AIRBGG
      CALL BGG(                                                         AIRBGG
     *   BD(7,JB),SEGLP(1,JB),D(1,1,JB),BD(4,JB),SEGLV(1,JB),WMEG(1,JB),AIRBGG
     *      B(1,K,J),SEGLP(1,NVEH),D(1,1,NVEH),BFB(1,K,J),SEGLV(1,NVEH),AIRBGG
     *      WMEG(1,NVEH),VSCS(J),IFULL(J),TV1(1,K,J),                   AIRBGG
     *      FRA(1,K),TORQ,TQB,VOLP(K,J))                                AIRBGG
      VOLBP(J) = VOLBP(J) + VOLP(K,J)                                   AIRBGG
      DO  26  I=1,3                                                     AIRBGG
      FORCE(I,J) = FORCE(I,J) + FRA(I,K)                                AIRBGG
   26 TORA (I,J) = TORA (I,J) + TORQ(I)                                 AIRBGG
C                                                                       AIRBGG
C     COMPUTE FORCE,TORQUE AND VOLUME OF INTERSECTION                   AIRBGG
C     OF AIRBAG WITH CONTACTING SEGMENT ELLIPSOIDS.                     AIRBGG
C                                                                       AIRBGG
      KBAG = MNBAG(J)                                                   AIRBGG
      DO  30  I=1,KBAG                                                  AIRBGG
      M  = MBAG(2,I,J)                                                  AIRBGG
      MM = MBAG(3,I,J)                                                  AIRBGG
      CALL BGG(                                                         AIRBGG
     *   BD(7,JB),SEGLP(1,JB),D(1,1,JB),BD(4,JB),SEGLV(1,JB),WMEG(1,JB),AIRBGG
     *      BD(7,MM),SEGLP(1,M),D(1,1,M),BD(4,MM),SEGLV(1,M),WMEG(1,M), AIRBGG
     *      VSCS(J),IFULL(J),TV2(1,I,J),FRB(1,I),TORQ,TQB(1,I),VOL(I))  AIRBGG
      IF  (VOL(I).EQ.0.0)  GO TO 30                                     AIRBGG
      VOLB = VOLB + VOL(I)                                              AIRBGG
      DO  28  K=1,3                                                     AIRBGG
      FORCE(K,J) = FORCE(K,J) + FRB(K,I)                                AIRBGG
   28 TORA (K,J) = TORA (K,J) + TORQ(K)                                 AIRBGG
   30 CONTINUE                                                          AIRBGG
      VOLBP(J) = VOLBP(J) + VOLB                                        AIRBGG
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```
31  RETURN                                                          AIRBGG
    END                                                             AIRBGG
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      SUBROUTINE AIRBG1                                                 AIRBG1
C                                                   REV IV    07/24/86SLIP
C     READS AND PRINTS THE INPUT CARDS THAT DESCRIBE THE PHYSICAL       AIRBG1
C     DIMENSIONS AND GAS DYNAMICS OF THE AIRBAG RESTRAINTS AND          AIRBG1
C     PERFORMS INITIALIZATION REQUIRED BY THE AIRBAG ROUTINE.           AIRBG1
C                                                                       AIRBG1
      IMPLICIT REAL*8 (A-H,O-Z)                                         AIRBG1
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           AIRBG1
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),AIRBG1
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       AIRBG1
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     AIRBG1
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    AIRBG1
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         AIRBG1
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           AIRBG1
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       AIRBG1
     *               JOINT(30),CGS(30),JS(30)                           AIRBG1
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      AIRBG1
      LOGICAL*1 CGS,JS                                                  AIRBG1
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         AIRBG1
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/INTEST/ SGTEST(3,4,30),XTEST(3,120),SEGT(120),REGT(120)    AIRBG1
      REAL    SEGT                                                      AIRBG1
      COMMON/ABDATA/ ZDEP(3,5),DBR(3,3,5),DPVCTR(3,5),DEPLOY(3,5),      AIRBG1
     *               AB(3,5),B(9,4,5),ZR(3,4,5),BFB(3,4,5),DRR(9,4,5),  AIRBG1
     *               VBAGG(5),VSCS(5),SPRK(5),CK(5),CMASS(5),CYMIN(5),  AIRBG1
     *               CYMOUT(5),BAGPV(5),PD(5),VBAG(5),VOLBP(5),         AIRBG1
     *               PCYV(5),PCYMIN(5),PVBAG(5),TV1(3,4,5),TV2(3,10,5), AIRBG1
     *               SWITCH(5),PYMOUT(5),SCALE(5),PREVT,IFULL(6)        AIRBG1
      COMMON/CYDATA/ CYTD(5),CYPA(5),CYSP(5),CYT0(5),CYV0(5),CYCD(5),   AIRBG1
     *               CYK(5),CYR(5),CYAT(5),CYPV(5),CYCD0(5),CYA0(5),    AIRBG1
     *               CYP0(5),CYSS(5),CYL0(5),CYC(5),CYRHO0(5),CYVMAX(5),AIRBG1
     *               CYORFC(5),CYRHO(5),CYT(5),CYP(5),CYV(5)            AIRBG1
      COMMON/TEMPVS/ TMP(9),TMP1(3),DMMY(35101)                         80386
      DIMENSION YB(3),YP(3),IDYPR(3)                                    AIRBG1
      REAL BAG(6)                                                       AIRBG1
      DATA BAG/4HBAG1,4HBAG2,4HBAG3,4HBAG4,4HBAG5,4HBAG /               AIRBG1
      DATA IDYPR/3,2,1/                                                 AIRBG1
      DATA MAXNPL/4/,MAXSEG/30/                                         CHGIII
C                                                                       AIRBG1
C     MAKE ROOM FOR BAG DATA IN SEGMENT ARRAYS BETWEEN VEH AND GRND.    AIRBG1
C                                                                       AIRBG1
      MSEG = 0                                                          CHGIII
      IF (NVEH.GT.NSEG) MSEG = NVEH - NSEG                              CHGIII
      L = NSEG + NBAG + MSEG + 1                                        CHGIII
      K = NSEG + MSEG + 1                                               CHGIII
      W(L)      = W(K)                                                  AIRBG1
      RW(L)     = RW(K)                                                 AIRBG1
      SEG(L)    = SEG(K)                                                AIRBG1
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      ISING(L) = ISING(K)                                               AIRBG1
      IF  (L-1.GT.NJNT)  JNT (L-1) = 0                                  AIRBG1
      IF  (L-1.GT.NJNT)  IPIN(L-1) = 0                                  AIRBG1
      DO  19  I=1,3                                                     AIRBG1
      SEGLP(I,L) = SEGLP(I,K)                                           AIRBG1
      SEGLV(I,L) = SEGLV(I,K)                                           AIRBG1
      SEGLA(I,L) = SEGLA(I,K)                                           AIRBG1
      WMEG (I,L) = WMEG (I,K)                                           AIRBG1
      WMEGD(I,L) = WMEGD(I,K)                                           AIRBG1
      PHI  (I,L) = PHI  (I,K)                                           AIRBG1
      RPHI (I,L) = RPHI (I,K)                                           AIRBG1
      DO  18  J=1,3                                                     AIRBG1
      D(I,J,L) = D(I,J,K)                                               AIRBG1
   18 SGTEST(I,J,L) = SGTEST(I,J,K)                                     AIRBG1
   19 SGTEST(I,4,L) = SGTEST(I,4,K)                                     AIRBG1
      NGRND = NSEG + NBAG + MSEG + 1                                    CHGIII
      IF (NGRND.GT.MAXSEG) STOP 75                                      CHGIII
      DO 40 J=1,NBAG                                                    AIRBG1
      JB = NVEH + J                                                     AIRBG1
C                                                                       AIRBG1
C     READ AND PRINT CARDS D.4.A -D.4.F FOR THE JTH AIRBAG.             AIRBG1
C                                                                       AIRBG1
      READ(5,13) (BAGTTL(I,J),I = 1,5),NPANEL(J),                       AIRBG1
     *             (AB(I,J),I=1,3) , (BD(I,JB),I=4,6),                  AIRBG1
     *              YB,(ZDEP(I,J),I=1,3),                               AIRBG1
     *             W(JB),CYTD(J),CYPA(J),CYSP(J),CYTO(J),CYVO(J),       AIRBG1
     *             CYCD(J),CYK(J),CYR(J),CYAT(J),CYPV(J),CYCDO(J),      AIRBG1
     *              CYAO(J),SPRK(J),VSCS(J),CK(J),CMASS(J)              AIRBG1
   13 FORMAT (5A4,I4/(6F12.0))                                          AIRBG1
      IF (NPANEL(J).GT.MAXNPL) STOP 76                                  CHGIII
      IF (MOD(J,2).EQ.1) WRITE(6,15) NPG                                PAGE
      IF (MOD(J,2).EQ.1) NPG=NPG+1                                      PAGE
   15 FORMAT('1',122X,'PAGE',I5/'  AIRBAG INPUTS',105X,'CARDS D.4')     PAGE
      WRITE(6,14) J,(BAGTTL(I,J),I = 1,5 ),                             AIRBG1
     *             (AB(I,J),I=1,3) , (BD(I,JB),I=4,6),                  AIRBG1
     *              YB,(ZDEP(I,J),I=1,3),                               AIRBG1
     *             W(JB),CYTD(J),CYPA(J),CYSP(J),CYTO(J),CYVO(J),       AIRBG1
     *             CYCD(J),CYK(J),CYR(J),CYAT(J),CYPV(J),CYCDO(J),      AIRBG1
     *              CYAO(J),SPRK(J),VSCS(J),CK(J),CMASS(J)              AIRBG1
   14 FORMAT('0 AIRBAG NO.',I4,4X,5A4//                                 AIRBG1
     * 29X,'AIR BAG SEMIAXES',46X,'C.G. OFFSET'/6X,6G20.9//             AIRBG1
     * 15X,'YAW',16X,'PITCH',15X,'ROLL',30X,'DEPLOYMENT POINT'          AIRBG1
     *                                               /6X,6G20.9//       AIRBG1
     * 15X,'XBM',16X,'CYTD',16X,'CYPA',16X,'CYSP',16X,'CYTO',16X,'CYVO' AIRBG1
     *                                               /6X,6G20.9//       AIRBG1
     * 14X,'CYCD',17X,'CYK',17X,'CYR',16X,'CYAT',16X,'CYPV',16X,'CYCDO' AIRBG1
     *                                               /6X,6G20.9//       AIRBG1
     *14X,'CYAO',16X,'SPRK',16X,'VSCS',17X,'CK',17X,'CMASS'/6X,5G20.9)  AIRBG1
      KP = NPANEL(J)                                                    AIRBG1
      DO  25  K=1,KP                                                    AIRBG1
C                                                                       AIRBG1
C     READ AND PRINT CARDS D.4.G AND D.4.H FOR THE KTH PANEL TO         AIRBG1
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C     CONTACT THE JTH AIRBAG. THESE PANELS ARE APPROXIMATED BY          AIRBG1
C     ELLIPSOIDS. THE FIRST PANEL (K=1) IS THE REACTION PANEL THAT      AIRBG1
C     INCLUDES THE DEPLOYMENT POINT.                                    AIRBG1
C                                                                       AIRBG1
      READ(5,11) (B(I,K,J),I=1,3),(BFB(I,K,J),I=1,3),                   AIRBG1
     *            (ZR(I,K,J),I=1,3),YP                                  AIRBG1
   11 FORMAT(6F12.0)                                                    AIRBG1
      WRITE(6,12) K,(B(I,K,J),I=1,3),(BFB(I,K,J),I=1,3),                AIRBG1
     *              (ZR(I,K,J),I=1,3),YP                                AIRBG1
   12 FORMAT('0 PANEL NO.',I4//                                         AIRBG1
     * 24X,'PANEL ELLIPSOID SEMIAXES',43X,'C.G. OFFSET'/6X,6G20.9//     AIRBG1
     * 29X,'PANEL LOCATION',32X,'YAW',16X,'PITCH',15X,'ROLL'/6X,6G20.9) AIRBG1
C                                                                       AIRBG1
C     CONVERT B FROM ELLIPSOID SEMIAXES TO MATRIX                       AIRBG1
C                                                                       AIRBG1
      DO 21 I=1,3                                                       AIRBG1
   21 TMP(I) = B(I,K,J)                                                 AIRBG1
      DO 22 I=1,9                                                       AIRBG1
   22 B(I,K,J) = 0.0                                                    AIRBG1
      DO 23 I=1,3                                                       AIRBG1
   23 B(4*I-3,K,J) = 1.0/TMP(I)**2                                      AIRBG1
      CALL DRCYPR (DRR(1,K,J),YP,IDYPR)                                 AIRBG1
      CALL MAT33 (B(1,K,J),DRR(1,K,J),TMP)                              AIRBG1
      CALL DOT33 (DRR(1,K,J),TMP,B(1,K,J))                              AIRBG1
      CALL DOT31 (DRR(1,K,J),BFB(1,K,J),TMP)                            AIRBG1
      DO  24  I=1,3                                                     AIRBG1
   24 BFB(I,K,J) = TMP(I) + ZR(I,K,J)                                   AIRBG1
   25 CONTINUE                                                          AIRBG1
C                                                                       AIRBG1
C     COMPUTE GEOMETRY OF DEPLOYMENT POINT ON FIRST PANEL.              AIRBG1
C                                                                       AIRBG1
      CALL DRCYPR (DBR(1,1,J),YB,IDYPR)                                 AIRBG1
      CALL DOT31 (DRR(1,1,J),ZDEP(1,J),DEPLOY(1,J))                     AIRBG1
      DO  31  I=1,3                                                     AIRBG1
      DPVCTR(I,J) = -DBR(1,I,J)                                         AIRBG1
   31 DEPLOY(I,J) = DEPLOY(I,J) + BFB(I,1,J)                            AIRBG1
      CALL PANEL (DBR(1,1,J),DEPLOY(1,J),JB)                            AIRBG1
C                                                                       AIRBG1
C     INITIALIZATION OF AIRBAG GEOMETRY.                                AIRBG1
C                                                                       AIRBG1
      VBAGG(J) = 4.0/3.0*PI*AB(1,J)*AB(2,J)*AB(3,J)                     AIRBG1
      PHI(1,JB) = (AB(2,J)**2+AB(3,J)**2)/5.0                           AIRBG1
      PHI(2,JB) = (AB(3,J)**2+AB(1,J)**2)/5.0                           AIRBG1
      PHI(3,JB) = (AB(1,J)**2+AB(2,J)**2)/5.0                           AIRBG1
      JNT(JB-1) = 0                                                     AIRBG1
      IPIN(JB-1) = 0                                                    AIRBG1
      SEG(JB) = BAG(J)                                                  AIRBG1
      IF  (NBAG.EQ.1)  SEG(JB) = BAG(6)                                 AIRBG1
      ISING(JB) = -1                                                    AIRBG1
      RW(JB) = G/W(JB)                                                  AIRBG1
      DO  36  I=1,3                                                     AIRBG1
      BD(I,JB) = 0.0                                                    AIRBG1
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      RPHI(I,JB) = 1.0/PHI(I,JB)                                        AIRBG1
      DO  36  K=1,4                                                     AIRBG1
   36 SGTEST(I,K,JB) = 0.0                                              AIRBG1
      DO  35  I=7,24                                                    AIRBG1
   35 BD(I,JB) = 0.0                                                    AIRBG1
      IFULL(J) = 0                                                      AIRBG1
      CYMOUT(J) = 0.0                                                   AIRBG1
      PYMOUT(J) = 0.0                                                   AIRBG1
      DO  38  I=1,3                                                     AIRBG1
      DO  37  K=1,4                                                     AIRBG1
   37 TV1(I,K,J) = 0.0                                                  AIRBG1
      DO  38  K=1,10                                                    AIRBG1
   38 TV2(I,K,J) = 0.0                                                  AIRBG1
C                                                                       AIRBG1
C     AIR CYLINDER INITIALIZATION                                       AIRBG1
C                                                                       AIRBG1
      CYP0(J) = CYSP(J)+CYPA(J)                                         AIRBG1
      CYSS(J) = DSQRT(CYK(J)*CYR(J)*CYT0(J)*G)                          AIRBG1
      CYL0(J) = CYV0(J)/CYAT(J)                                         AIRBG1
      CYK1    = CYK(J)-1.0                                              AIRBG1
      CYK2    = 0.5*(CYK(J)+1.0)                                        AIRBG1
      CYK3    = CYK2**(-CYK2/CYK1)                                      AIRBG1
      CYC(J)  = 0.5*CYK1*CYSS(J)*CYCD(J)/CYL0(J)*CYK3                   AIRBG1
      CYRHO0(J) = CYP0(J)/(CYR(J)*CYT0(J))                              AIRBG1
      CYVMAX(J) = CYV0(J)/CYK(J)*CYP0(J)/CYPA(J)                        AIRBG1
      CYORFC(J) = CYCD0(J)*CYA0(J)*G*DSQRT(2.0*CYPA(J)*CYK(J))/CYSS(J)  AIRBG1
      IF (NPRT(22).NE.0) WRITE(6,39)                                    AIRBG1
     *     (SEGLP(I,JB),I=1,3),(SEGLV(I,JB),I=1,3),(WMEG(I,JB),I=1,3),  AIRBG1
     *     VBAGG(J),CYP0(J),CYSS(J),CYC(J),CYRHO0(J),CYVMAX(J),CYORFC(J)AIRBG1
   39 FORMAT('0 AIRBAG SINPUT'/(1X,9G14.6))                             AIRBG1
   40 CONTINUE                                                          AIRBG1
      PREVT = 0.0                                                       AIRBG1
      RETURN                                                            AIRBG1
      END                                                               AIRBG1
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      SUBROUTINE AIRBG3(IRESET)                                          AIRBG3
C                                                       REV IV   07/23/86TWOPI
C                                                                        AIRBG3
C     THIS SUBROUTINE IS CALLED BY SUBROUTINE UPDATE AT START (IRESET=1)AIRBG3
C     AND END (IRESET=2) OF EACH INTEGRATION STEP TO DETERMINE IF EACH  AIRBG3
C     AIRBAG HAS BEEN FULLY INFLATED.                                    AIRBG3
C                                                                        AIRBG3
      IMPLICIT REAL*8 (A-H,O-Z)                                          AIRBG3
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,            AIRBG3
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),AIRBG3
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)        AIRBG3
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), AIRBG3
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), AIRBG3
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)                AIRBG3
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),          NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF          AIRBG3
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)            EDGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                          AIRBG3
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                   TWOPI
      COMMON/ABDATA/ ZDEP(3,5),DBR(3,3,5),DPVCTR(3,5),DEPLOY(3.5),       AIRBG3
     *               AB(3,5),B(9,4,5),ZR(3,4,5),BFB(3,4,5),DRR(9,4,5),   AIRBG3
     *               VBAGG(5),VSCS(5),SPRK(5),CK(5),CMASS(5),CYMIN(5),   AIRBG3
     *               CYMOUT(5),BAGPV(5),PD(5),VBAG(5),VOLBP(5),          AIRBG3
     *               PCYV(5),PCYMIN(5),PVBAG(5),TV1(3,4,5),TV2(3,10,5), AIRBG3
     *               SWITCH(5),PYMOUT(5),SCALE(5),PREVT,IFULL(6)         AIRBG3
      COMMON/CYDATA/ CYTD(5),CYPA(5),CYSP(5),CYT0(5),CYV0(5),CYCD(5),    AIRBG3
     *               CYK(5),CYR(5),CYAT(5),CYPV(5),CYCD0(5),CYA0(5),     AIRBG3
     *               CYP0(5),CYSS(5),CYL0(5),CYC(5),CYRHO0(5),CYVMAX(5),AIRBG3
     *               CYORFC(5),CYRHO(5),CYT(5),CYP(5),CYV(5)             AIRBG3
      COMMON/TEMPVS/ TMP(9),TMP1(3),DMMY(35101)                          80386
      CALL ELTIME(1,29)                                                  AIRBG3
      JRESET = IRESET                                                    AIRBG3
      IF  (JRESET.EQ.1)  PREVT = TIME                                    AIRBG3
      NBGSF = 0                                                          AIRBG3
      DO  50  J=1,NBAG                                                   AIRBG3
      IF  (MNBAG(J).EQ.0)  GO TO 50                                      AIRBG3
      JB = NVEH + J                                                      AIRBG3
      JFULL = IFULL(J) + 2                                               AIRBG3
      IF  (JFULL.LT.1 .OR. JFULL.GT.3)  GO TO 11                         AIRBG3
      IF (JRESET-1) 13,13,14                                             BUTLER1
   11 WRITE(6,12)  TIME                                                  AIRBG3
   12 FORMAT ('0 ERROR IN SUBROUTINE AIRBG3 AT TIME =',F10.6)            AIRBG3
      STOP 32                                                            AIRBG3
   13 IF (JFULL-2) 41,49,49                                              BUTLER1
   14 IF (JFULL-2) 11,21,31                                              BUTLER1
C                                                                        AIRBG3
C     END OF INTEGRATION STEP WHEN IFULL=0. TEST FOR FULL INFLATION.     AIRBG3
C                                                                        AIRBG3
   21 PD(J) = 0.0                                                        AIRBG3
      PCYV(J) = CYV(J)                                                   AIRBG3
      PCYMIN(J) = CYMIN(J)                                               AIRBG3
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      PVBAG(J) = VBAG(J)                                                AIRBG3
   22 CALL AIRBGG(J)                                                    AIRBG3
      VBAG(J) = CYV(J) + VOLBP(J)                                       AIRBG3
      IF  (SCALE(J).EQ.1.0)  GO TO 23                                   AIRBG3
      SCALE(J) = (VBAG(J)/VBAGG(J))**THIRD                              AIRBG3
      IF  (SCALE(J).LT.1.0)  GO TO 24                                   AIRBG3
      SCALE(J) = 1.0                                                    AIRBG3
      GO TO 22                                                          AIRBG3
   23 IFULL(J) = -1                                                     AIRBG3
      CYMOUT(J) = 0.0                                                   AIRBG3
      PSW1 = (VBAG (J)-VBAGG(J))*PCYV(J)/PCYMIN(J)                      AIRBG3
      PSW2 = (VBAGG(J)-PVBAG(J))* CYV(J)/ CYMIN(J)                      AIRBG3
      SWITCH(J) = (PSW1+PSW2)/(VBAG(J)-PVBAG(J))                        AIRBG3
      BAGPV(J) = CYPA(J)*(CYMIN(J)*SWITCH(J))**CYK(J)                   AIRBG3
      PD(J) = BAGPV(J)/(CYV(J)**CYK(J)) - CYPA(J)                       AIRBG3
   24 DO  25  K=1,3                                                     AIRBG3
      BD(K,JB) = SCALE(J)*AB(K,J)                                       AIRBG3
      IF  (SCALE(J).EQ.0.0)  GO TO 25                                   AIRBG3
      BD(4*K+12,JB) = BD(K,JB)**2                                       AIRBG3
      BD(4*K+ 3,JB) = 1.0/BD(4*K+12,JB)                                 AIRBG3
   25 TMP(K) = DEPLOY(K,J) + BD(1,JB)*DPVCTR(K,J)                       AIRBG3
      CALL PANEL (DBR(1,1,J),TMP,JB)                                    AIRBG3
C                                                                       AIRBG3
C     SET UP BAGSF ARRAY FOR OUTPUT.                                    AIRBG3
C                                                                       AIRBG3
   31 BAGSF(1,NBGSF+1) = CYP(J)                                         AIRBG3
      BAGSF(2,NBGSF+1) = CYT(J)                                         AIRBG3
      BAGSF(3,NBGSF+1) =  PD(J)                                         AIRBG3
      CALL DOT31 (D(1,1,JB),BD(4,JB),TMP)                               AIRBG3
      DO  32  K=1,3                                                     AIRBG3
      BAGSF(K,NBGSF+3) = BD(K,JB)                                       AIRBG3
   32 TMP(K) = TMP(K) + SEGLP(K,JB) - SEGLP(K,NVEH)                     AIRBG3
      CALL MAT31 (D(1,1,NVEH),TMP,BAGSF(1,NBGSF+2))                     AIRBG3
      CALL YPRDEG (D(1,1,JB),BAGSF(1,NBGSF+4))                          AIRBG3
      NBGSF = NBGSF + 5 + NPANEL(J) + MNBAG(J)                          AIRBG3
      GO TO 50                                                          AIRBG3
C                                                                       AIRBG3
C     START OF INTEGRATION STEP WITH IFULL = -1, RESET INTEGRATOR.      AIRBG3
C                                                                       AIRBG3
   41 IFULL(J) = 1                                                      AIRBG3
      IRESET = -1                                                       AIRBG3
   49 PYMOUT(J) = CYMOUT(J)                                             AIRBG3
   50 CONTINUE                                                          AIRBG3
      CALL ELTIME(2,29)                                                 AIRBG3
      RETURN                                                            AIRBG3
      END                                                               AIRBG3
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```
      SUBROUTINE BELTG (ZA,ZB,ZC,BD)                                    BELTG
C                                              REV IV    07/23/86TWOPI
C     COMPUTE TANGENT POINTS, UNIT VECTORS FROM TANGENT POINTS TO       BELTG
C     ANCHOR POINTS AND LENGTHS OF THE BELT SEGMENTS.                   BELTG
C                                                                       BELTG
C     ARGUMENTS:                                                        BELTG
C                                                                       BELTG
C         ZA,ZB - ANCHOR POINTS RELATIVE TO ELLIPSOID CENTER.           BELTG
C         ZC    - FIXED POINT OF BELT ON SEGMENT ELLIPSOID.             BELTG
C         BD    - SEGMENT ELLIPSOID SEMIAXES AND CENTER.                BELTG
C                                                                       BELTG
C     RESULTS ARE RETURNED TO CALLING ROUTINE VIA COMMON/TEMPVS/.       BELTG
C                                                                       BELTG
      IMPLICIT REAL*8 (A-H,O-Z)                                         BELTG
      DIMENSION ZA(3),ZB(3),ZC(3),BD(24)                                BELTG
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           BELTG
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         BELTG
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
C     NOTE: BELTRT AND BELTG SHARE FIRST PART OF TEMPVS                 BELTG
      COMMON/TEMPVS/ APA(3),UVA(3),DLGA,UAA,APB(3),UVB(3),DLGB,UBB      BELTG
     *              ,TA(3),TB(3),TC(3),UP(3),B(3)                       BELTG
     *              ,UC(3),AX(3),XE(3),BX(3),ACA(3),ACB(3),DMMY(35064)  80386
C                                                                       BELTG
C     COMPUTE                                                           BELTG
C       TC: NORMALIZED VECTOR OF BELT PLANE DETERMINED                  BELTG
C           BY ANCHOR POINTS AND FIXED POINT.                           BELTG
C                                                                       BELTG
      DO 10 K=1,3                                                       BELTG
      TA(K) = ZC(K)-ZA(K)                                               BELTG
   10 TB(K) = ZC(K)-ZB(K)                                               BELTG
      CALL CROSS(TB,TA,TC)                                              BELTG
      S = DSQRT(TC(1)**2 + TC(2)**2 + TC(3)**2)                         BELTG
      TC(1) = TC(1)/S                                                   BELTG
      TC(2) = TC(2)/S                                                   BELTG
      TC(3) = TC(3)/S                                                   BELTG
C                                                                       BELTG
C     GET DISTANCE OF BELT PLANE TO CENTER OF ELLIPSIOD.                BELTG
C                                                                       BELTG
      BET = TC(1)*ZC(1)+TC(2)*ZC(2)+TC(3)*ZC(3)                         BELTG
C                                                                       BELTG
C     COMPUTE                                                           BELTG
C       XE: CENTER OF ELLIPSE DETERMINED BY INTERSECTION                BELTG
C           OF BELT PLANE AND SEGMENT ELLIPSOID.                        BELTG
C                                                                       BELTG
      CALL MAT31 (BD(16),TC,XE)                                         BELTG
      GG = BET/(TC(1)*XE(1)+TC(2)*XE(2)+TC(3)*XE(3))                    BELTG
      DLGA = 0.0                                                        BELTG
      DLGB = 0.0                                                        BELTG
      DO 15 K=1,3                                                       BELTG
      XE(K)  = XE(K)*GG                                                 BELTG
      UC(K)  = ZC(K)-XE(K)                                              BELTG
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      APA(K) = UC(K)                                                   BELTG
   15 APB(K) = UC(K)                                                   BELTG
      YAY = GG*BET                                                     BELTG
      YAY1 = 1.0-YAY                                                   BELTG
      IF (YAY1.LE.EPS(6)) GO TO 70                                     BELTG
C                                                                      BELTG
C     CALCULATE POSSIBLE TANGENT POINTS FROM                           BELTG
C       UVA,UVB: VECTORS FROM ELLIPSE CENTER TO MIDPOINT OF            BELTG
C                LINE CONNECTING POSSIBLE TANGENT POINTS.              BELTG
C       ACA,ACB: VECTORS FROM UVA,UVB TO TANGENT POINTS (POSITIVE).    BELTG
C                                                                      BELTG
      CALL MAT31 (BD(7),ZA,AX)                                         BELTG
      CALL MAT31 (BD(7),ZB,BX)                                         BELTG
      ZZA = AX(1)*ZA(1)+AX(2)*ZA(2)+AX(3)*ZA(3)                        BELTG
      IF( ZZA.LE.1.0) STOP 88                                          CHGIII
      ZZB = BX(1)*ZB(1)+BX(2)*ZB(2)+BX(3)*ZB(3)                        BELTG
      IF( ZZB.LE.1.0) STOP 89                                          CHGIII
      C2A = YAY1/(ZZA-YAY)                                             BELTG
      C2B = YAY1/(ZZB-YAY)                                             BELTG
      CALL CROSS(TC,AX,ACA)                                            BELTG
      CALL CROSS(TC,BX,ACB)                                            BELTG
      TTA = 0.0                                                        BELTG
      TTB = 0.0                                                        BELTG
      DO 21 I=1,3                                                      BELTG
      DO 21 J=1,3                                                      BELTG
      K = 3*J+I+3                                                      BELTG
      TTA = TTA + ACA(I)*BD(K)*ACA(J)                                  BELTG
   21 TTB = TTB + ACB(I)*BD(K)*ACB(J)                                  BELTG
      C3A = DSQRT((1.0 - C2A)*YAY1/TTA)                                CHGIII
      C3B = DSQRT((1.0 - C2B)*YAY1/TTB)                                CHGIII
      TT = DSQRT(UC(1)**2 + UC(2)**2 + UC(3)**2)                       BELTG
      DO 24 K=1,3                                                      BELTG
      UVA(K) = C2A*(ZA(K)-XE(K))                                       BELTG
      UVB(K) = C2B*(ZB(K)-XE(K))                                       BELTG
      ACA(K) = C3A*ACA(K)                                              BELTG
      ACB(K) = C3B*ACB(K)                                              BELTG
      UC(K) = UC(K)/TT                                                 BELTG
   24 B(K) = 0.0                                                       BELTG
C                                                                      BELTG
C     OBTAIN EQUATION OF ELLIPSE                                       BELTG
C        B1*X**2 + 2*B2*X*Y + B3*Y**2 = 1                              BELTG
C     IN UC,UP COORDINATES WHERE UC POINTS TO FIXED POINT.             BELTG
C                                                                      BELTG
      CALL CROSS(TC,UC,UP)                                             BELTG
      DO 22 I=1,3                                                      BELTG
      DO 22 J=1,3                                                      BELTG
      K = 3*J+I+3                                                      BELTG
      B(1) = B(1) + UC(I)*BD(K)*UC(J)                                  BELTG
      B(2) = B(2) + UC(I)*BD(K)*UP(J)                                  BELTG
   22 B(3) = B(3) + UP(I)*BD(K)*UP(J)                                  BELTG
      B(1) = B(1)/YAY1                                                 BELTG
      B(2) = B(2)/YAY1                                                 BELTG
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      B(3) = B(3)/YAY1                                                    BELTG
C                                                                         BELTG
C     COMPUTE ANGLES FROM FIXED POINT TO POSSIBLE TANGENT POINTS.         BELTG
C                                                                         BELTG
      UCUVA = UC(1)*UVA(1) + UC(2)*UVA(2) + UC(3)*UVA(3)                  BELTG
      UCUVB = UC(1)*UVB(1) + UC(2)*UVB(2) + UC(3)*UVB(3)                  BELTG
      UCACA = UC(1)*ACA(1) + UC(2)*ACA(2) + UC(3)*ACA(3)                  BELTG
      UCACB = UC(1)*ACB(1) + UC(2)*ACB(2) + UC(3)*ACB(3)                  BELTG
      UPUVA = UP(1)*UVA(1) + UP(2)*UVA(2) + UP(3)*UVA(3)                  BELTG
      UPUVB = UP(1)*UVB(1) + UP(2)*UVB(2) + UP(3)*UVB(3)                  BELTG
      UPACA = UP(1)*ACA(1) + UP(2)*ACA(2) + UP(3)*ACA(3)                  BELTG
      UPACB = UP(1)*ACB(1) + UP(2)*ACB(2) + UP(3)*ACB(3)                  BELTG
      TH1 = DATAN2(UPUVA-UPACA,UCUVA-UCACA)                               BELTG
      TH2 = DATAN2(UPUVA+UPACA,UCUVA+UCACA)                               BELTG
      TH3 = DATAN2(UPUVB-UPACB,UCUVB-UCACB)                               BELTG
      TH4 = DATAN2(UPUVB+UPACB,UCUVB+UCACB)                               BELTG
      IF (TH1.LT.0.0) TH1 = TWOPI + TH1                                   BELTG
      IF (TH2.LT.0.0) TH2 = TWOPI + TH2                                   BELTG
      IF (TH3.LT.0.0) TH3 = TWOPI + TH3                                   BELTG
      IF (TH4.LT.0.0) TH4 = TWOPI + TH4                                   BELTG
C                                                                         BELTG
C     CHOOSE PROPER TANGENT POINTS AND BELT ARC LENGTHS.                  BELTG
C                                                                         BELTG
      THMIN = DMIN1(TH1,TH2,TH3,TH4)                                      BELTG
      IF (THMIN.EQ.TH1.AND.DMIN1(TH2,TH3,TH4).NE.TH4) GO TO 61            BELTG
      IF (THMIN.EQ.TH2.AND.DMAX1(TH1,TH3,TH4).EQ.TH4) GO TO 61            BELTG
      IF (THMIN.EQ.TH3.AND.DMIN1(TH1,TH2,TH4).NE.TH2) GO TO 63            BELTG
      IF (THMIN.EQ.TH4.AND.DMAX1(TH1,TH2,TH3).EQ.TH2) GO TO 63            BELTG
      GO TO 70                                                            BELTG
   61 THA = TH1                                                           BELTG
      THB = TWOPI-TH4                                                     BELTG
      DO 62 K=1,3                                                         BELTG
      APA(K) = UVA(K)-ACA(K)                                              BELTG
   62 APB(K) = UVB(K)+ACB(K)                                              BELTG
      GO TO 65                                                            BELTG
   63 THA = TWOPI-TH2                                                     BELTG
      THB = TH3                                                           BELTG
      DO 64 K=1,3                                                         BELTG
      APA(K) = UVA(K)+ACA(K)                                              BELTG
   64 APB(K) = UVB(K)-ACB(K)                                              BELTG
   65 CONTINUE                                                            BELTG
      EPS1 = EPS(1)                                                       BELTG
      DLGA = DABS(ELONG(B(1),B(2),B(3),EPS1,THA))                         BELTG
      DLGB = DABS(ELONG(B(1),B(2),B(3),EPS1,THB))                         BELTG
C                                                                         BELTG
C     CALCULATE BELT LENGTHS AND UNIT VECTORS                             BELTG
C     FROM TANGENT POINTS TO ANCHOR POINTS.                               BELTG
C                                                                         BELTG
   70 UAA=0.                                                              BELTG
      UBB=0.                                                              BELTG
      DO 80 K=1,3                                                         BELTG
      APA(K) = APA(K)+XE(K)                                               BELTG
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      APB(K) = APB(K)+XE(K)                                            BELTG
      UVA(K)=ZA(K)-APA(K)                                              BELTG
      UVB(K)=ZB(K)-APB(K)                                              BELTG
      APA(K)=APA(K)+BD(K+3)                                            BELTG
      APB(K)=APB(K)+BD(K+3)                                            BELTG
      UAA=UAA+UVA(K)**2                                                BELTG
      UBB=UBB+UVB(K)**2                                                BELTG
   80 CONTINUE                                                         BELTG
      UAA=DSQRT(UAA)                                                   BELTG
      UBB=DSQRT(UBB)                                                   BELTG
      DO 90 K=1,3                                                      BELTG
      UVA(K)=UVA(K)/UAA                                                BELTG
      UVB(K)=UVB(K)/UBB                                                BELTG
   90 CONTINUE                                                         BELTG
C                                                                      BELTG
C     OPTIONAL OUTPUT                                                  BELTG
C                                                                      BELTG
      IF (NPRT(15).EQ.0) GO TO 99                                      BELTG
      WRITE(6,50)                                                      BELTG
   50 FORMAT(1X,'BELT RESTRAINT')                                      BELTG
      WRITE(6,60) APA,UVA,DLGA,UAA                                     BELTG
      WRITE(6,60) APB,UVB,DLGB,UBB                                     BELTG
   60 FORMAT (1X,1P8D15.5)                                             BELTG
   99 CONTINUE                                                         BELTG
      RETURN                                                           BELTG
      END                                                              BELTG
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      SUBROUTINE BELTRT(I,II,MM,M NT)                                  BELTRT
C                                                   REV IV    07/23/86TWOPI
C     THE ROUTINE CALLS SUBROUTINE BELTG TO COMPUTE THE TANGENT POINTS  BELTRT
C     AND BELT LENGTHS AND APPLIES THE RESTRAINT FORCES TO THE U1 ARRAY BELTRT
C     AND BELT TORQUES TO THE U2 ARRAY FOR ELLIPSOID(II) ATTACHED TO    BELTRT
C     BODY SEGMENT (I) BY BELT (M) ATTACHED TO SEGMENT (MM).            BELTRT
C                                                                       BELTRT
      IMPLICIT REAL*8(A-H,O-Z)                                          BELTRT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           BELTRT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),BELTRT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       BELTRT
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         BELTRT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         BELTRT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 TGMOD4
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
C     NOTE: BELTRT AND BELTG SHARE FIRST PART OF TEMPVS                 BELTRT
      COMMON/TEMPVS/ APA(3),UVA(3),DLGA,UAA,APB(3),UVB(3),DLGB,UBB      BELTRT
     *            ,DMMY(35097)                                          80386
      DIMENSION TA(3),TB(3),ZA(3),ZB(3),TT(3),TTT(3),TA1(3),TB1(3)      TGMOD4
C                                                                       BELTRT
      CALL ELTIME(1,22)                                                 BELTRT
C                                                                       BELTRT
C     CONVERT SEGMENT POSITION TO SEGMENT REFERENCE.                    BELTRT
C                                                                       BELTRT
      MA = MOD(MM,100)                                                  JTF984
      MB = MM/100                                                       JTF984
      IF (MB.EQ.0) MB=MA                                                JTF984
      CALL DOT31 (D(1,1,MA),BELT(1,M),TA)                               BELTRT
      CALL DOT31 (D(1,1,MB),BELT(4,M),TB)                               BELTRT
      DO  10  K=1,3                                                     BELTRT
      TA(K) = SEGLP(K,MA) + TA(K) - SEGLP(K,I)                          BELTRT
   10 TB(K) = SEGLP(K,MB) + TB(K) - SEGLP(K,I)                          BELTRT
      CALL MAT31 (D(1,1,I),TA,ZA)                                       BELTRT
      CALL MAT31 (D(1,1,I),TB,ZB)                                       BELTRT
      DO  13  K=1,3                                                     BELTRT
      ZA(K) = ZA(K) - BD(K+3,II)                                        BELTRT
   13 ZB(K) = ZB(K) - BD(K+3,II)                                        BELTRT
C                                                                       BELTRT
C     COMPUTE NEW BELT LENGTHS AND EXPANSION.                           BELTRT
C                                                                       BELTRT
      CALL BELTG (ZA, ZB, BELT(7,M), BD(1,II))                          BELTRT
      TLA = DLGA+UAA                                                    BELTRT
      TLB = DLGB+UBB                                                    BELTRT
      TL  = TLA+TLB                                                     BELTRT
      IF  (TIME.NE.0.0)  GO TO 11                                       BELTRT
C                                                                       BELTRT
C     IF TIME=0, COMPUTE INITIAL BELT LENGTHS                           BELTRT
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C     AND STORE RESULTS IN BELT ARRAY.                                  BELTRT
C                                                                       BELTRT
      IF (BELT(11,M).LT.0.0) BELT(11,M)= -BELT(11,M)-TL                 BELTRT
      IF (BELT(11,M).LT.0.0) BELT(11,M)=0.0                             BELTRT
      BELT(12,M) = TLA+TLA/TL*BELT(11,M)                                BELTRT
      BELT(13,M) = TLB+TLB/TL*BELT(11,M)                                BELTRT
      B1213 = BELT(12,M) + BELT(13,M)                                   BELTRT
      BELT(10,M) = B1213                                                BELTRT
      DO 305 LL=1,3                                                     TGMOD4
      TA1(LL) = APA(LL)                                                 TGMOD4
  305 TB1(LL) = APB(LL)                                                 TGMOD4
      IF(LPMI(I).EQ.0) GO TO 306                                        TGMOD4
      CALL DOT31(DPMI(1,1,I),APA,TA1)                                   TGMOD4
      CALL DOT31(DPMI(1,1,I),APB,TB1)                                   TGMOD4
  306 CONTINUE                                                          TGMOD4
      WRITE (6,14) M, B1213, BELT(12,M), BELT(13,M), UNITL,I,TA1, TB1   TGMOD4
   14 FORMAT('0 INITIAL LENGTHS OF BELT NO.',I3,' AND ITS SEGMENTS ARE',BELTRT
     *        3F12.4,1X,A4/'0 INITIAL TANGENT POINTS IN LOCAL REFERENCE TGMOD4
     *OF SEGMENT ',I2,' ARE:',/,2(3X,3F12.3))                           TGMOD4
C                                                                       BELTRT
C     CONVERT TANGENT POINTS TO INERTIAL REFERENCE AND STORE.           BELTRT
C                                                                       BELTRT
   11 CALL DOT31 (D(1,1,I),APA,TPTS(1,M))                               BELTRT
      CALL DOT31 (D(1,1,I),APB,TPTS(4,M))                               BELTRT
      DO  12  K=1,3                                                     BELTRT
      TPTS(K  ,M) = TPTS(K  ,M) + SEGLP(K,I)                            BELTRT
   12 TPTS(K+3,M) = TPTS(K+3,M) + SEGLP(K,I)                            BELTRT
      SDOT = 0.0                                                        BELTRT
      NCF = NTAB(NT+5)                                                  BELTRT
      IF  (NCF.NE.0)  GO TO 15                                          BELTRT
C                                                                       BELTRT
C     ZERO BELT FRICTION, COMPUTE STRAIN AND FORCE OF ENTIRE BELT.      BELTRT
C                                                                       BELTRT
      B1213 = BELT(12,M)+BELT(13,M)                                     BELTRT
      S = (TL-B1213)/B1213                                              BELTRT
      SA = S                                                            BELTRT
      SB = S                                                            BELTRT
      IF  (S.LT.0.0)  S = 0.0                                           BELTRT
      CALL FRCDFL (S,SDOT,NT,1,FA,ELOSS)                                BELTRT
      FB = FA                                                           BELTRT
      GO TO 17                                                          BELTRT
C                                                                       BELTRT
C     FULL BELT FRICTION, COMPUTE STRAIN AND FORCE OF EACH PART OF BELT.BELTRT
C                                                                       BELTRT
   15 IF  (TL.GT.BELT(10,M))  GO TO 16                                  BELTRT
      FA = 0.0                                                          BELTRT
      FB = 0.0                                                          BELTRT
      SA = (TL-BELT(10,M))/BELT(10,M)                                   BELTRT
      SB = SA                                                           BELTRT
      BELT(12,M) = TLA                                                  BELTRT
      BELT(13,M) = TLB                                                  BELTRT
      GO TO 17                                                          BELTRT
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   16 S = (TLA-BELT(12,M))/BELT(12,M)                                 BELTRT
      SA = S                                                           BELTRT
      IF  (S.LT.0.0)  S = 0.0                                          BELTRT
      CALL FRCDFL (S,SDOT,NT,1,FA,ELOSS)                               BELTRT
      S = (TLB-BELT(13,M))/BELT(13,M)                                  BELTRT
      SB = S                                                           BELTRT
      IF  (S.LT.0.0)  S = 0.0                                          BELTRT
      CALL FRCDFL (S,SDOT,NT+6,1,FB,ELOSS)                             BELTRT
      BELT(10,M) = 0.0                                                 BELTRT
   17 BSF(1,NBSF) = SA                                                 BELTRT
      BSF(2,NBSF) = FA                                                 BELTRT
      BSF(3,NBSF) = SB                                                 BELTRT
      BSF(4,NBSF) = FB                                                 BELTRT
      IF  (FA+FB.LE.0.0)  GO TO 31                                     BELTRT
C                                                                      BELTRT
C     COMPUTE FORCE VECTORS.                                           BELTRT
C                                                                      BELTRT
      DO  20  K=1,3                                                    BELTRT
      UVA (K) = FA*UVA(K)                                              BELTRT
   20 UVB(K) = FB*UVB(K)                                               BELTRT
C                                                                      BELTRT
C     CONVERT FORCES TO INERTIAL REFERENCE AND ADD TO U1 ARRAY.        BELTRT
C                                                                      BELTRT
      CALL DOT31(D(1,1,I),UVA,TT )                                     BELTRT
      CALL DOT31(D(1,1,I),UVB,TTT)                                     BELTRT
      DO 30 K=1,3                                                      BELTRT
       U1(K,MA) = U1(K,MA) - TT(K)                                     JTF984
       U1(K,MB) = U1(K,MB) - TTT(K)                                    JTF984
   30 U1(K,I) = U1(K,I)+TTT(K) + TT(K)                                 JTF984
C                                                                      BELTRT
C     CONVERT TORQUES TO LOCAL REFERENCE AND ADD TO U2 ARRAY.          BELTRT
C                                                                      BELTRT
       CALL MAT31(D(1,1,MA),TT,ZA)                                     JTF984
       CALL MAT31(D(1,1,MB),TTT,ZB)                                    JTF984
       CALL CROSS(BELT(1,M),ZA,TA)                                     JTF984
       CALL CROSS(BELT(4,M),ZB,TB)                                     JTF984
      CALL CROSS(APA,UVA,TT)                                           BELTRT
      CALL CROSS(APB,UVB,TTT)                                          BELTRT
      DO 40 K=1,3                                                      BELTRT
       U2(K,MA) = U2(K,MA) - TA(K)                                     JTF984
       U2(K,MB) = U2(K,MB) - TB(K)                                     JTF984
   40 U2(K,I) = U2(K,I)+(TT(K)+TTT(K))                                 BELTRT
   31 CONTINUE                                                         BELTRT
      CALL ELTIME(2,22)                                                BELTRT
      RETURN                                                           BELTRT
      END                                                              BELTRT
```

```
      SUBROUTINE BGG(A,ZA,DA,BFA,VA,WA,                                 BGG
     *               B,ZB,DB,BFB,VB,WB,                                 BGG
     *               VSCS,IFULL,TV,FRA,TORQ,TQB,VOL)                    BGG
C                                                 REV IV   07/23/86TWOPI
C     COMPUTES THE VOLUME OF INTERSECTION OF AN ELLIPSOIDAL AIRBAG      BGG
C     WITH AN ELLIPSOIDAL BODY SEGMENT OR REACTION PANEL.               BGG
C     ALSO COMPUTES THE FORCE PER UNIT PRESSURE AND TORQUE PER UNIT     BGG
C     PRESSURE ON BOTH THE BAG AND THE INTERSECTING OBJECT.             BGG
C                                                                       BGG
C     ARGUMENTS:                                                        BGG
C      AIRBAG INPUTS : A(3,3) - ELLIPSOID MATRIX                        BGG
C                      ZA(3)  - C.G.                                    BGG
C                      DA(3,3)- DIRECTION COSINE MATRIX                 BGG
C                      BFA(3) - OFFSET                                  BGG
C                      VA(3)  - CG VELOCITY(INERTIAL REF.)              BGG
C                      WA(3)  - ANGULAR VELOCITY (LOCAL REF.)           BGG
C                                                                       BGG
C      CONTACT SURFACE B(3,3) - ELLIPSOID MATRIX                        BGG
C                      ZB(3)  - C.G.                                    BGG
C                      DB(3,3)- DIRECTION COSINE MATRIX                 BGG
C                      BFB(3) - OFFSET                                  BGG
C                      VB(3)  - CG VELOCITY (INERTIAL REF.)             BGG
C                      WB(3)  - ANGULAR VELOCITY (LOCAL REF.)           BGG
C                      VSCS   - COEFFICIENT OF SLIDING FRICTION         BGG
C                      IFULL  - IF ZERO, COMPUTE VOL ONLY.              BGG
C                      TV(3)  - MEMORY FOR SUBROUTINES INTERS & EDEPTH. BGG
C                                                                       BGG
C            OUTPUT  : FRA(3) - FORCE ON BAG                            BGG
C                      TORQ(3)- TORQUE ON BAG                           BGG
C                      TOB(3) - TORQUE ON CONTACT SURFACE               BGG
C                      VOL    - VOLUME OF INTERSECTION                  BGG
      IMPLICIT REAL*8 (A-H,O-Z)                                         BGG
      DIMENSION A(3,3),ZA(3),DA(3,3),BFA(3),VA(3),WA(3),B(3,3),ZB(3),   BGG
     *          DB(3,3),BFB(3),VB(3),WB(3),FRA(3),TORQ(3),TQB(3),TV(3)  BGG
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         BGG
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TEMPVS/ DUMMY(200),DAB(3,3),BA(3,4),TEMP(3,3),Y(3),CPA(3), BGG
     *               CPB(3),PLANE(4,3),FORCE(3),CBB(3),VLM(3),FRB(3),   BGG
     *      YFA(3),YFB(3),ZBB(3),T1(3),T2(3),T3(3),T4(3),T5(3),T6(3)    BGG
     *             ,DMMY(34823)                                         80386
C     NOTE: DUMMY IS USED BY SUBROUTINES AIRBAG AND AIRBGG.             BGG
C                                                                       BGG
C     INITIALIZATION                                                    BGG
C                                                                       BGG
      S3TEST = 10.0                                                     BGG
      VOL=0.                                                            BGG
      DO 5 I=1,3                                                        BGG
      FRA(I)  = 0.0                                                     BGG
      TORQ(I) = 0.0                                                     BGG
      TQB (I) = 0.0                                                     BGG
      BA(I,4)=-BFA(I)                                                   BGG
      DO 5 J=1,3                                                        BGG
```

```
      BA(I,4)=BA(I,4)+DA(I,J)*(ZB(J)-ZA(J))                             BGG
      DAB(I,J)=0.                                                       BGG
      DO 5 K=1,3                                                        BGG
    5 DAB(I,J)=DAB(I,J)+DA(I,K)*DB(J,K)                                 BGG
C                                                                       BGG
C     COMPUTE DISTANCE BETWEEN ELLIPSOID CENTERS AND                    BGG
C     CONVERT ELLIPSOID MATRIX OF OBJECT TO AIRBAG REFERENCE.           BGG
C                                                                       BGG
      DO 10 I=1,3                                                       BGG
      DO 10 J=1,3                                                       BGG
      TEMP(I,J) = 0.0                                                   BGG
      BA(I,4)=BA(I,4)+DAB(I,J)*BFB(J)                                   BGG
      DO 10 K=1,3                                                       BGG
   10 TEMP(I,J) = TEMP(I,J) + B(I,K)*DAB(J,K)                           BGG
      CALL MAT33(DAB,TEMP,BA)                                           BGG
C                                                                       BGG
C     CHECK FOR INTERSECTION AND DETERMINE POINTS OF MAXIMUM PENETRATIONBGG
C                                                                       BGG
      TB = 1.0                                                          BGG
      CALL INTERS (A,BA,BA(1,4),TB,Y,TV(1),T1)                          BGG
      IF (TB.GT.1.0) RETURN                                             BGG
      CALL EDEPTH (A,BA,BA(1,4),TB,Y,CPA,CPB,TV(2),TV(3))               BGG
C                                                                       BGG
C     SET UP ORTHOGONAL SYSTEM USING VECTOR BETWEEN POINTS              BGG
C     OF MAXIMUM PENETRATION AS ONE AXIS.                               BGG
C                                                                       BGG
      P = 0.                                                            BGG
      DO 20  I=1,3                                                      BGG
      PLANE(I,3) = CPA(I)-CPB(I)                                        BGG
   20 P = PLANE(I,3)**2+P                                               BGG
      IF  (P.LT.EPS(6))  GO TO 99                                       BGG
      PP = DSQRT(P)                                                     BGG
      DO 25  I=1,3                                                      BGG
   25 TEMP(I,1) = PLANE(I,3)/PP                                         BGG
      CALL ORTHO(PLANE,TEMP,4)                                          BGG
C                                                                       BGG
C     DEFINE PLANES AT MAXIMUM PENETRATION POINTS.                      BGG
C                                                                       BGG
      DO 40  I=1,3                                                      BGG
      PLANE(4,I) = 0.0                                                  BGG
      DO 40  J=1,3                                                      BGG
   40 PLANE(4,I) = PLANE(4,I)+PLANE(J,I)*CPB(J)                         BGG
      DO 45 K=1,3                                                       BGG
   45 CBB(K)=CPB(K)-BA(K,4)                                             BGG
C                                                                       BGG
C     ESTIMATES OF VOLUME AND AREA BASED ON RADII OF CURVATURE          BGG
C         AND PENETRATION.                                              BGG
C                                                                       BGG
      IP=2                                                              BGG
      AREA=PI                                                           BGG
      DO 70 L=1,2                                                       BGG
      RA=RCRT(A,PLANE,CPA,L)                                            BGG
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      RB=RCRT(BA,PLANE,CB3,L)                                           BGG
      IF(PP.GT.RA)RA=PP                                                 BGG
      R=(RA-RB)*.5                                                      BGG
      RC=(RA+RB)*.5                                                     BGG
      VP=PP/(RA+RB)                                                     BGG
      VD=VP                                                             BGG
      ALP=RC*DSQRT(VP*(2.-VP))                                          BGG
      IF(R.GE.0.)GO TO 60                                               BGG
      AB=RA+RB-PP                                                       BGG
      BET=(RA**2-RB**2+AB**2)*.5/AB                                     BGG
      ALP=DSQRT(RA**2-BET**2)                                           BGG
      R=0.                                                              BGG
      VD=1.-BET/RA                                                      BGG
      VP=(PP+BET-RA)/RB                                                 BGG
   60 VLM(L)=RB*(RB*VP)**2*(1.-VP/3.)+RA*(RA*VD)**2*(1.-VD/3.)         BGG
      IF(R.GT.0.)VLM(L)=VLM(L)-ALP*R*R*(PI-2.*(DASIN(1.-VP)+            BGG
     *  (1.-VP)*ALP/RC))                                                BGG
      VLM(L)=VLM(L)*PI                                                  BGG
      AREA=AREA*ALP                                                     BGG
   70 IP=1                                                              BGG
      VOL=(VLM(1)+VLM(2))*.5                                            BGG
      IF  (IFULL.EQ.0)  GO TO 99                                        BGG
C                                                                       BGG
C     SET UP FORCE VECTOR ALONG LINE OF MAXIMUM PENETRATION.            BGG
C                                                                       BGG
      CALL DOT31(DAB,CBB,ZBB)                                           BGG
      DO 76 K=1,3                                                       BGG
      YFA(K)=CPB(K)+BFA(K)                                              BGG
      YFB(K)=ZBB(K)+BFB(K)                                              BGG
      FORCE(K) = -AREA*PLANE(K,3)                                       BGG
   76 T1(K) = VA(K)-VB(K)                                               BGG
C                                                                       BGG
C     COMPUTE ANGULAR VELOCITY COMPONENTS,RELATIVE VELOCITY, COMPONENTS BGG
C     OF RELATIVE VELOCITY ALONG MAX PENETRATION LINE AND MAGNITUDE OF  BGG
C     FORCE.                                                            BGG
C                                                                       BGG
      CALL MAT31(DA,T1,T2)                                              BGG
      CALL CROSS(WA,YFA,T1)                                             BGG
      CALL CROSS(WB,YFB,T3)                                             BGG
      CALL MAT31(DAB,T3,T4)                                             BGG
      FM = 0.0                                                          BGG
      SUM = 0.0                                                         BGG
      DO 77 K=1,3                                                       BGG
      T5(K) = T2(K)+T1(K)-T4(K)                                         BGG
      SUM = SUM+T5(K)*PLANE(K,3)                                        BGG
   77 FM = FM+FORCE(K)**2                                               BGG
C                                                                       BGG
C     COMPUTE COMPONENTS OF RELATIVE VELOCITY IN TANGENT PLANE,         BGG
C     FRICTION FORCE AND TOTAL FORCE VECTOR.                            BGG
C                                                                       BGG
      S3 = 0.0                                                          BGG
      DO 78 K=1,3                                                       BGG
```

```
      T6(K) = T5(K)-SUM*PLANE(K,3)                                        BGG
   78 S3 = S3+T6(K)**2                                                    BGG
      SQ3 = DSQRT(S3)                                                     BGG
      IF (SQ3.LT.S3TEST) SQ3=S3TEST/(2.0-SQ3/S3TEST)                      BGG
      FF = VSCS*DSQRT(FM)/SQ3                                             BGG
      DO 79 K=1,3                                                         BGG
   79 FORCE(K) = FORCE(K)-FF*T6(K)                                        BGG
C                                                                         BGG
C     COMPUTE FRB: FORCE ON REACTION SURFACE IN ITS LOCAL REFERENCE.      BGG
C            TORQ: TORQUE ON AIRBAG IN AIRBAG REFERENCE.                  BGG
C             TQB: TORQUE ON REACTION SURFACE IN ITS LOCAL REFERENCE.     BGG
C             FRA: FORCE ON AIRBAG IN INERTIAL REFERENCE.                 BGG
C                                                                         BGG
      CALL DOT31(DAB,FORCE,FRB)                                           BGG
      CALL CROSS(YFA,FORCE,TORQ)                                          BGG
      CALL CROSS(FRB,YFB,TQB)                                             BGG
      CALL DOT31(DA,FORCE,FRA)                                            BGG
   99 RETURN                                                              BGG
      END                                                                 BGG
```

```
      SUBROUTINE BINPUT                                                  BINPUT
C                                                    REV IV    07/24/86SLIP
C     READS THE INPUT CARDS THAT CONTAINS THE PHYSICAL DIMENSIONS AND    BINPUT
C     CHARACTERISTICS OF THE CRASH VICTIM'S BODY SEGMENTS AND JOINTS.    BINPUT
C                                                                        BINPUT
      IMPLICIT REAL*8(A-H,O-Z)                                           BINPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,            BINPUT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60),  SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),      BINPUT
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)     BINPUT
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)            EDGE
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),            BINPUT
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),        BINPUT
     *               JOINT(30),CGS(30),JS(30)                            BINPUT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT       BINPUT
      LOGICAL*1 CGS,JS                                                   BINPUT
      COMMON/INTEST/ SGTEST(3,4,30),XTEST(3,120),SEGT(120),REGT(120)     BINPUT
      REAL    SEGT                                                       BINPUT
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)           BINPUT
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),        JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                      JDRIFT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                          BINPUT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                   TWOPI
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                  ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)         TTHKREF
      LOGICAL*1 EULER,SLIP,LDMMY                                         80386
      COMMON/TEMPVS/ YPR1(3,30),YPR2(3,30),YPR3(3,30),YPRPMI(3,30),      BINPUT
     *               T1(6),TMP1(3,3),TMP2(3,3),KNT(30),IDYPR(6,30),      SLIP
     *               EULER(30),LDMMY(2),DMMY(34620)                      80386
      DATA MXNSEG/30/,MXNJNT/30/,MNFLX/8/                                MISC
      CALL ELTIME(1, 2)                                                  BINPUT
      IDYPRT = 0                                                         TGMOD5
C                                                                        BINPUT
C     INPUT CARD B.1                                                     BINPUT
C                                                                        BINPUT
      READ (5,11) NSEG,NJNT,BDYTTL                                       BINPUT
   11 FORMAT (2I6,8X,5A4)                                                BINPUT
      IF (NSEG.GT.MXNSEG) STOP 77                                        MISC
      IF (NJNT.GT.MXNJNT) STOP 78                                        MISC
C                                                                        BINPUT
C     INPUT CARDS  B.2.I  FOR EACH SEGMENT                               BINPUT
C                                                                        BINPUT
      DO  12  I=1,NSEG                                                   BINPUT
      READ (5,13) SEG(I),CGS(I),W(I),(PHI(J,I),J=1,3),                   BINPUT
     *            (BD(J,I),J=1,6),LPMI(I)                                BINPUT
   13 FORMAT(A4,1X,A1,10F6.0,I4)                                         BINPUT
      DO  81  J=1,3                                                      BINPUT
      IDYPR(J,I) = 4 J                                                   BINPUT
   81 YPRPMI(J,I) = 0.0                                                  BINPUT
      IF  (LPMI(I).EQ.0)  GO TO 12                                       BINPUT
      READ (5,82) (YPRPMI(J,I),J=1,3)                                    BINPUT
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```
   82 FORMAT(12X,3F6.0)                                                BINPUT
   12 CALL DRCYPR (DPMI(1,1,I),YPRPMI(1,I),IDYPR(1,I))                 BINPUT
C                                                                      BINPUT
C     INPUT CARDS  B.3.J  FOR EACH JOINT.                              BINPUT
C                                                                      BINPUT
      NFLX = 0                                                         BINPUT
      IF (NJNT.EQ.0) GO TO 27                                          BINPUT
      SLIP = .FALSE.                                                   SLIP
      DO  14  J=1,NJNT                                                 BINPUT
      READ (5,15) JOINT(J),JS(J),JNT(J),IPIN(J),(SR(I,2*J-1),I=1,3),   BINPUT
     *            (SR(I,2*J),I=1,3),IEULER(J),CONST(1,J),CONST(2,J),   SLIP
     *            (YPR1(I,J),I=1,3),(YPR2(I,J),I=1,3),                 SLIP
     *            (YPR3(I,J),I=1,3),(IDYPR(I,J),I=1,6)                 BINPUT
      ID1 = IDYPR(1,J)                                                 BINPUT
      ID4 = IDYPR(4,J)                                                 BINPUT
      EULER(J) = .FALSE.                                               SLIP
      IF (IPIN(J).EQ.4) EULER(J) = .TRUE.                              SLIP
      IF (IEULER(J).EQ.0.AND.IPIN(J).LE.-4) EULER(J) = .TRUE.          SLIP
      IF (.NOT.EULER(J).AND.IABS(IPIN(J)).GE.5) SLIP = .TRUE.          SLIP
      IF(ID1.NE.0.OR.ID4.NE.0) IDYPRT = 1                              TGMOD5
      DO 479 II=1,6                                                    TGMOD5
  479 IF(IABS(IDYPR(II,J)).GT.3) STOP 101                              TGMOD5
      DO  14  I=1,3                                                    BINPUT
      IF  (ID1.EQ.0)  IDYPR(I  ,J) = 4-I                               BINPUT
   14 IF  (ID4.EQ.0)  IDYPR(I+3,J) = 4-I                               BINPUT
   15 FORMAT(A4,1X,A1,2I4,6F6.0,I4,2F6.0/14X,9F6.0,6I2)                SLIP
C                                                                      BINPUT
C     COMPUTE NFLX AND NFLEX ARRAY FROM NEGATIVE VALUES OF JNT(J).     BINPUT
C     NFLX WILL BE NUMBER OF CONSTRAINT TORQUES FOR FLEXIBLE SEGMENTS. BINPUT
C     NFLEX(1, ) REFERENCE SEGMENT (LOWEST NUMBERED SEGMENT OF CHAIN)  BINPUT
C     NFLEX(2, ) INTERIOR SEGMENT NUMBERS                              BINPUT
C     NFLEX(3, ) TERMINATING SEGMENT (HIGHEST NUMBERED SEGMENT IN CHAIN)BINPUT
C     VALUES OF NFLEX NEED NOT BE SEQUENTIAL BUT MUST BE ORDERED.      BINPUT
C     FLEXIBLE SEGMENT MUST BE SIMPLE CHAIN, I.E., BRANCHING SEGMENTS  BINPUT
C     CANNOT BE ATTACHED TO INTERIOR SEGMENTS BUT MAY BE ATTACHED TO   BINPUT
C     REFERENCE OR TERMINATING SEGMENTS.                               BINPUT
C                                                                      BINPUT
      DO  16  J=1,NJNT                                                 BINPUT
   16 KNT(J) = JNT(J)                                                  BINPUT
      DO  22  J=1,NJNT                                                 BINPUT
      IF (KNT(J).GE.0) GO TO 22                                        BINPUT
      NFA = NFLX+1                                                     BINPUT
      IT = J+1                                                         BINPUT
      IF (IT.GT.NJNT) GO TO 18                                         BINPUT
      JP1 = J+1                                                        BINPUT
      DO  17  L=JP1,NJNT                                               BINPUT
      IF (IABS(KNT(L)).NE.IT) GO TO 17                                 BINPUT
      KL = KNT(L)                                                      BINPUT
      KNT(L) = 0                                                       BINPUT
      IF (KL.GT.0) GO TO 18                                            BINPUT
      NFLX = NFLX+1                                                    BINPUT
      NFLEX(1,NFLX) = IABS(KNT(J))                                     BINPUT
```

```
      NFLEX(2,NFLX) = IT                                              BINPUT
      IT = L+1                                                        BINPUT
   17 CONTINUE                                                        BINPUT
   18 IF (NFLX.GE.NFA) GO TO 20                                       BINPUT
      WRITE (6,19)                                                    BINPUT
   19 FORMAT('0ERROR IN DEFINING FLEXIBLE SEGMENTS, ONLY ONE NEGATIVE JNBINPUT
     *T IN STRING. PROGRAM TERMINATED.')                              BINPUT
      STOP 3                                                          BINPUT
   20 DO  21  K=NFA,NFLX                                              BINPUT
   21 NFLEX(3,K) = IT                                                 BINPUT
   22 CONTINUE                                                        BINPUT
C                                                                     BINPUT
C     INPUT CARDS  B.4.J  FOR EACH JOINT.                             BINPUT
C                                                                     BINPUT
      DO  23  J=1,NJNT                                                BINPUT
      READ (5,24) (SPRING(I,3*J-2),I=1,5),(SPRING(I,3*J-1),I=1,5)     BINPUT
   23 IF (EULER(J)) READ(5,24)(SPRING(I,3*J),I=1,5),(ANG(I,J),I=1,3)  SLIP
   24 FORMAT(2(4F6.0,F12.0))                                          BINPUT
C                                                                     BINPUT
C     INPUT CARDS  B.5.J  FOR EACH JOINT.                             BINPUT
C                                                                     BINPUT
      DO  25  J=1,NJNT                                                BINPUT
      READ (5,26) (VISC(I,3*J-2),I=1,7)                               BINPUT
      IF (.NOT.EULER(J)) GO TO 25                                     SLIP
      READ (5,26) (VISC(I,3*J-1),I=1,7)                               BINPUT
      READ (5,26) (VISC(I,3*J  ),I=1,7)                               BINPUT
   25 CONTINUE                                                        BINPUT
   26 FORMAT(5F6.0,18X,2F6.0)                                         BINPUT
C                                                                     BINPUT
C     INPUT CARDS  B.6.I  FOR EACH SEGMENT.                           BINPUT
C                                                                     BINPUT
   27 DO  28  I=1,NSEG                                                BINPUT
   28 READ (5,29) ((SGTEST(J,K,I),J=1,3),K=1,4)                       BINPUT
   29 FORMAT(12F6.0)                                                  BINPUT
C                                                                     BINPUT
C     PRINT CARD B.1                                                  BINPUT
C                                                                     BINPUT
      WRITE (6,30) BDYTTL,NSEG,NJNT,NPG,UNITM,UNITT,UNITL,UNITL,      PAGE
     *             UNITL,UNITM                                        PAGE
      NPG=NPG+1                                                       PAGE
   30 FORMAT('1 CRASH VICTIM',5X,5A4,I5,' SEGMENTS',I5,' JOINTS',58X, PAGE
     *  'PAGE',I5/120X,'CARD  B.1'/25X,'PRINCIPAL MOMENTS OF INERTIA', PAGE
     *      14X,'SEGMENT CONTACT ELLIPSOID',28X,'CARDS B.2'/          BINPUT
     *      3X,'SEGMENT',6X,'WEIGHT',7X,'(',A4,'-',A4,'**2 ',A4,')',  BINPUT
     *      11X,'SEMIAXES (',A4,')',12X,'CENTER (',A4,')',            BINPUT
     *      11X,'PRINCIPAL AXES (DEG)'/                               BINPUT
     *      '  I  SYM PLOT   (',A4,')',7X,'X',8X,'Y',8X,'Z ',         BINPUT
     *      2(9X,'X',7X,'Y',7X,'Z'),8X,'YAW',5X,'PITCH',5X,'ROLL'/)   BINPUT
C                                                                     BINPUT
C     PRINT CARDS  B.2.I  FOR EACH SEGMENT.                           BINPUT
C                                                                     BINPUT
      DO  31  I=1,NSEG                                                BINPUT
```

```
   31 WRITE (6,32) I,SEG(I),CGS(I),W(I),(PHI(J,I),J=1,3),                  BINPUT
     *             (BD(J,I),J=1,6),(YPRPMI(J,I),J=1,3)                     BINPUT
   32 FORMAT(I3,1X,A4,2X,A1,F11.3,2X,3F9.4,2(2X,3F8.3),1X,3F9.2)           BINPUT
      IF (NJNT.EQ.0) GO TO 50                                              BUTLER1
C                                                                          BINPUT
C     PRINT CARDS  B.3.J  FOR EACH JOINT.                                  BINPUT
C                                                                          BINPUT
      IF(IDYPRT.EQ.0) WRITE(6,33) UNITL,UNITL                              TGMOD5
      IF(IDYPRT.EQ.1) WRITE(6,733) UNITL,UNITL                             TGMOD5
   33 FORMAT(///120X,'CARDS B.3'/                                          BINPUT
     * 3X,'JOINT',15X,'LOCATION(',A4,') - SEG(JNT)',                       BINPUT
     *            3X,'LOCATION(',A4,') - SEG(J+1)',                        BINPUT
     *            2X, 'PRIN. AXIS(DEG) - SEG(JNT)',                        BINPUT
     *            2X, 'PRIN. AXIS(DEG) - SEG(J+1)'/                        BINPUT
     * '  J SYM PLOT JNT PIN', 2(6X,'X',8X,'Y',8X,'Z',3X),                 BINPUT
     *            2(5X,'YAW',5X,'PITCH',5X,'ROLL',1X) /)                   BINPUT
  733 FORMAT(///120X,'CARDS B.3'/                                          TGMOD5
     * 3X,'JOINT',15X,'LOCATION(',A4,') - SEG(JNT)',                       TGMOD5
     *            3X,'LOCATION(',A4,') - SEG(J+1)',                        TGMOD5
     *            2X, 'PRIN. AXIS(DEG) - SEG(JNT)',                        TGMOD5
     *            2X, 'PRIN. AXIS(DEG) - SEG(J+1)'/                        TGMOD5
     * '  J SYM PLOT JNT PIN', 2(6X,'X',8X,'Y',8X,'Z',3X),                 TGMOD5
     *            'ID1  YAW ID2 PITCH ID3 ROLL ',                          TGMOD5
     *            'ID4  YAW ID5 PITCH ID6 ROLL ',/)                        TGMOD5
      DO  34  J=1,NJNT                                                     BINPUT
      IF(IDYPRT.EQ.0)                                                      TGMOD5
     *WRITE (6,35) J,JOINT(J),JS(J),JNT(J),IPIN(J),(SR(I,2*J-1),I=1,3),    TGMOD5
     *             (SR(I,2*J),I=1,3),(YPR1(I,J),I=1,3),(YPR2(I,J),I=1,3)BINPUT
      IF(IDYPRT.EQ.1)                                                      TGMOD5
     *WRITE(6,735) J,JOINT(J),JS(J),JNT(J),IPIN(J),(SR(I,2*J-1),I=1,3),    TGMOD5
     *             (SR(I,2*J),I=1,3),(IDYPR(I,J),YPR1(I,J),I=1,3),         TGMOD5
     *             (IDYPR(I+3,J),YPR2(I,J),I=1,3)                          TGMOD5
      IF (.NOT.EULER(J)) GO TO 34                                          SLIP
      IEULER(J) = 8                                                        BINPUT
      IF (IPIN(J).EQ.4) GO TO 34                                           BINPUT
      IEULER(J) = 11 + IPIN(J)                                             BINPUT
      IPIN(J) = -4                                                         BINPUT
   34 CONTINUE                                                             BINPUT
   35 FORMAT(I3,1X,A4,2X,A1,2X,2I3,2(1X,3F9.3),2(1X,3F9.2) )               BINPUT
  735 FORMAT(I3,1X,A4,2X,A1,2X,2I3,2(1X,3F9.3),2(1X,3(1X,I1,F7.2)))        TGMOD5
      IF (.NOT.SLIP) GO TO 89                                              SLIP
      WRITE (6,83) UNITM,UNITM                                             SLIP
   83 FORMAT(//'  UNLOCK CONDITIONS FOR SLIP JOINTS'/                      SLIP
     *        '     JOINT     TENSION     COMPRESSION'/                    SLIP
     *   14X,'(',A4,')',7X,'(',A4,')'/)                                    SLIP
      DO 85 J = 1,NJNT                                                     SLIP
      IF (EULER(J)) GO TO 85                                               SLIP
      IF (IABS(IPIN(J)).LT.5) GO TO 85                                     SLIP
      WRITE (6,84) J,CONST(1,J),CONST(2,J)                                 SLIP
   84 FORMAT(1X,I6,4X,F10.3,3X,F10.3)                                      SLIP
   85 CONTINUE                                                             SLIP
C                                                                          BINPUT
```

```
C     SET UP HT MATRIX FROM YPR1 & YPR2 INPUT.                              BINPUT
C     HA IS 3RD COLUMN & HB IS 2ND COLUMN OF HT.                            BINPUT
C     FOR A SLIP JOINT(IPIN=7),HB IS 3RD COLUMN OF HT.                      SLIP
C                                                                           BINPUT
89    IF  (NPRT(23).NE.0)  WRITE (6,36) NPG                                 SLIP
      IF  (NPRT(23).NE.0)  NPG=NPG+1                                        PAGE
   36 FORMAT('1 HT ARRAY AS COMPUTED FROM YPR1 & YPR2 INPUT.',77X,          PAGE
     *        'PAGE',I5)                                                    PAGE
      DO  38  J=1,NJNT                                                      BINPUT
      SR(4,2*J-1) = 0.0                                                     SLIP
      SR(4,2*J  ) = 0.0                                                     SLIP
      CALL DRCYPR (TMP1,YPR1(1,J),IDYPR(1,J))                               BINPUT
      CALL DRCYPR (TMP2,YPR2(1,J),IDYPR(4,J))                               BINPUT
      DO 37 I=1,3                                                           BINPUT
      ANGD(I,J) = 0.0                                                       BINPUT
      HA(I,2*J-1) = 0.0                                                     BINPUT
      HA(I,2*J  ) = 0.0                                                     BINPUT
      K = 2                                                                 SLIP
      IF (IABS(IPIN(J)).EQ.7) K = 3                                         SLIP
      HB(I,2*J-1) = TMP1(K,I)                                               SLIP
      HB(I,2*J  ) = TMP2(K,I)                                               SLIP
      DO 77 K=1,3                                                           SLIP
      HT(I,K,2*J-1) = TMP1(K,I)                                             SLIP
   77 HT(I,K,2*J  ) = TMP2(K,I)                                             SLIP
      IF (.NOT.EULER(J)) GO TO 37                                           SLIP
      CONST(I,J) = YPR3(I,J)*RADIAN                                         SLIP
      ANG(I,J) = ANG(I,J)*RADIAN - CONST(I,J)                               SLIP
   37 CONTINUE                                                              SLIP
   38 IF  (NPRT(23).NE.0)  WRITE (6,39) J,JOINT(J),                         BINPUT
     *    ((HT(I,K,2*J-1),K=1,3),(HT(I,K,2*J),K=1,3),I=1,3)                 BINPUT
   39 FORMAT('0',I4,2X,A4,3X,3F12.6,3X,3F12.6/(14X,3F12.6,3X,3F12.6))       BINPUT
C                                                                           BINPUT
C     PRINT CARDS  B.4.J  FOR EACH JOINT.                                   BINPUT
C                                                                           BINPUT
      WRITE (6,41) NPG,UNITL,UNITM,UNITL,UNITM                              PAGE
      NPG=NPG+1                                                             PAGE
   41 FORMAT('1 JOINT TORQUE CHARACTERISTICS',93X,                          PAGE
     *        'PAGE',I5/120X,'CARDS B.4'/                                   PAGE
     *23X,'FLEXURAL SPRING CHARACTERISTICS',28X,'TORSIONAL SPRING' ,        BINPUT
     *' CHARACTERISTICS'//                                                  BINPUT
     *15X,'SPRING COEF. (',2A4,'/DEG**J)',6X,'ENERGY     JOINT',            BINPUT
     * 7X,'SPRING COEF. (',2A4,'/DEG**J)',6X,'ENERGY     JOINT'/     '     JBINPUT
     *OINT ',2(8X.'LINEAR    QUADRATIC     CUBIC     DISSIPATION  STOP ')BINPUT
     */8X,2(8X,'(J=1)',7X,'(J=2)',7X,'(J=3)',7X,'COEF.     (DEG)')/)        BINPUT
      DO  42  J=1,NJNT                                                      BINPUT
      J1 = 3*J-2                                                            BINPUT
      J2 = 3*J-1                                                            BINPUT
      J3 = 3*J                                                              BINPUT
      WRITE (6,43) J,JOINT(J),((SPRING(I,JJ),I=1,5),JJ=J1,J2)               BINPUT
   42 IF (EULER(J)) WRITE (6,44) (SPRING(I,J3),I=1,5)                       SLIP
   43 FORMAT(I3,1X,A4,2(3X,3F12.3,2F10.3))                                  BINPUT
   44 FORMAT(11X,3F12.3,2F10.3)                                             BINPUT
```

```
C                                                                      BINPUT
C     PRINT CARDS B.5.J  FOR EACH JOINT.                               BINPUT
C                                                                      BINPUT
      WRITE (6,46) (UNITL,UNITM,UNITT,I=1,2),(UNITL,UNITM,I=1,2),UNITT  BINPUT
   46 FORMAT(///120X,'CARDS B.5'/                                      BINPUT
     *38X,'JOINT VISCOUS CHARACTERISTICS AND LOCK-UNLOCK CONDITIONS'// BINPUT
     *14X,'VISCOUS',9X,'COULOMB',7X,'FULL FRICTION',5X,'MAX TORQUE FOR',BINPUT
     *4X,'MIN TORQUE FOR',4X,'MIN. ANG. VELOCITY',6X,'IMPULSE'/        BINPUT
     *2X,'JOINT',5X,'COEFFICIENT',4X,'FRICTION COEF. ANGULAR VELOCITY', BINPUT
     *4X,'A LOCKED JOINT',4X,'UNLOCKED JOINT',4X,'FOR UNLOCKED JOINT', BINPUT
     *4X,'RESTITUTION'/                                                BINPUT
     *8X,'(',3A4,'/DEG)  (',2A4,')',6X,'(DEG/',A4,')',10X,'(',2A4,')', BINPUT
     *8X,'(',2A4,')',10X,'(RAD/',A4,')',8X,'COEFFICIENT'/ )            BINPUT
      DO  47  J=1,NJNT                                                 BINPUT
      J1 = 3*J-2                                                       BINPUT
      J2 = 3*J-1                                                       BINPUT
      J3 = 3*J                                                         BINPUT
      WRITE (6,48) J,JOINT(J),(VISC(I,J1),I=1,7)                       BINPUT
   47 IF (EULER(J)) WRITE (6,49) ((VISC(I,JJ),I=1,7),JJ=J2,J3)         SLIP
   48 FORMAT(I3,1X,A4,F13.3,2F15.2,F22.2,F18.2,F20.2,F17.3)            BINPUT
   49 FORMAT(      8X,F13.3,2F15.2,F22.2,F18.2,F20.2,F17.3)            BINPUT
C                                                                      BINPUT
C     PRINT CARDS  B.6..  FOR EACH SEGMENT.                            BINPUT
C                                                                      BINPUT
   50 WRITE (6,51) NPG,(UNITT,UNITL,UNITT,I=1,2)                       PAGE
      NPG=NPG+1                                                        PAGE
   51 FORMAT('1',122X,'PAGE',I5/20X,                                   PAGE
     *    'SEGMENT INTEGRATION CONVERGENCE TEST INPUT',58X,'CARDS B.6'//PAGE
     *     17X,'ANGULAR VELOCITIES',  11X,'LINEAR VELOCITIES',         BINPUT
     *     10X,'ANGULAR ACCELERATIONS',9X,'LINEAR ACCELERATIONS'/      BINPUT
     *    21X,'(RAD/',A4,')', 18X,'(',A4,'/',A4,')',                   BINPUT
     *    17X,'(RAD/',A4,'**2)', 16X,'(',A4,'/',A4,'**2)'/             BINPUT
     *    ' SEGMENT', 4('        MAG.      ABS.      REL.')   /        BINPUT
     *    ' NO. SYM', 4('        TEST     ERROR     ERROR')   /)       BINPUT
      DO 52 I=1,NSEG                                                   BINPUT
   52 WRITE (6,53) I,SEG(I),((SGTEST(J,K,I),J=1,3),K=1,4)              BINPUT
   53 FORMAT(I3,1X,A4,4(F11.3,F9.3,F9.4) )                             BINPUT
      IF (NFLX.EQ.0) GO TO 62                                          BINPUT
C                                                                      BINPUT
C     INPUT AND PRINT CARDS B.7                                        BINPUT
C     CARD B.7.A  NFX: NO. OF INTERIOR SEGMENTS OF FLEXIBLE ELEMENTS.  BINPUT
C                 KNT(J),J=1,NFX: THE SEGMENT NUMBERS.                 BINPUT
C                                                                      BINPUT
      READ (5,54) NFX,(KNT(J),J=1,NFX)                                 BINPUT
   54 FORMAT(18I4)                                                     BINPUT
      IF (NFX.NE.NFLX) WRITE (6,55) NFX,NFLX                           BINPUT
   55 FORMAT('0INPUT ERROR ON CARD B.7.A, NFX =',I4, ' BUT NFLX =',I4/ BINPUT
     *        ' AS COMPUTED FROM CARDS B.3. PROGRAM TERMINATED.')      BINPUT
      IF  (NFX.NE.NFLX)  STOP 4                                        BINPUT
      WRITE (6,56) NPG                                                 PAGE
      NPG=NPG+1                                                        PAGE
   56 FORMAT('1',122X,'PAGE',I5/121X,'CARDS B.7')                      PAGE
```

```
      DO 60 JJ=1,NFX                                                    BINPUT
      DO  57  K=1,NFLX                                                  BINPUT
      IF (KNT(JJ).EQ.NFLEX(2,K)) GO TO 59                               BINPUT
   57 CONTINUE                                                          BINPUT
      WRITE (6,58) KNT(JJ)                                              BINPUT
   58 FORMAT('0INPUT ERROR ON CARD B.7.J, SEGMENT NO.',I4,' IS NOT AN INBINPUT
     *TERIOR SEGMENT OF A FLEXIBLE ELEMENT FROM DATA ON CARDS B.3.'/    BINPUT
     *       ' PROGRAM TERMINATED.')                                    BINPUT
      STOP 5                                                            BINPUT
   59 IF(NFLX.GT.MNFLX) STOP 99                                         TGMOD5
C                                                                       BINPUT
C     CARDS B.7.J  HF ARRAY FOR SEGMENT KNT(JJ)                         BINPUT
C                                                                       BINPUT
      READ (5,29) ((HF(I,J,K),J=1,12),I=1,4)                            TGMOD5
      DO 737 LL=1,3                                                     TGMOD5
      L = (LL-1)*4                                                      TGMOD5
      DO 737 I=1,4                                                      TGMOD5
      DO 737 J=1,4                                                      TGMOD5
  737 IF(HF(I,J+L,K).NE.HF(J,I+L,K)) STOP 100                           TGMOD5
   60 WRITE (6,61) KNT(JJ),K,(NFLEX(I,K),I=1,3),                        BINPUT
     *             ((HF(I,J,K),J=1,12),I=1,4)                           BINPUT
   61 FORMAT('0 HF ARRAY FOR INTERIOR SEGMENT NO.',I4,20X,              BINPUT
     *       '(NFLEX(I,',I1,'),I=1,3) =',3I6//                          BINPUT
     *       (3X,4F10.4,3X,4F10.4,3X,4F10.4) )                          BINPUT
   62 IF (NJNT.EQ.0) GO TO 65                                           BINPUT
C                                                                       BINPUT
C     CHANGE SPRING AND VISC FROM DEG TO RAD                            BINPUT
C                                                                       BINPUT
      DO  64  I=1,NJNT                                                  BINPUT
      J1 = 3*I-2                                                        BINPUT
      J2 = 3*I-1                                                        BINPUT
      IF (EULER(I)) J2= 3*I                                             SLIP
      DO 63 J=J1,J2                                                     BINPUT
      SPRING(1,J) = SPRING(1,J)/RADIAN                                  BINPUT
      SPRING(2,J) = SPRING(2,J)/RADIAN**2                               BINPUT
      SPRING(3,J) = SPRING(3,J)/RADIAN**3                               BINPUT
      SPRING(5,J) = SPRING(5,J)*RADIAN                                  BINPUT
   63 CONTINUE                                                          BINPUT
      IF (.NOT.EULER(I)) J2 = J1                                        SLIP
      DO 64 J=J1,J2                                                     BINPUT
      VISC  (1,J) = VISC  (1,J)/RADIAN                                  BINPUT
   64 VISC  (3,J) = VISC  (3,J)*RADIAN                                  BINPUT
C                                                                       BINPUT
C     W ARRAY HAS BEEN SUPPLIED IN LBS. SET UP RECIPROCAL MASS (RW)     BINPUT
C     AND MOMENT OF INERTIA (RPHI) ARRAYS. HOWEVER, IF W OR ANY ELEMENT BINPUT
C     OF PHI IS ZERO, SEGMENT WILL BE CONSIDERED SINGULAR (ISING=1) AND BINPUT
C     ALL RECIPROCALS WILL BE ZERO SO AS TO NULLIFY COMPUTATIONS IN THE BINPUT
C     DAUX ROUTINES. NS IS THE NUMBER OF SINGULAR SEGMENTS.             BINPUT
C                                                                       BINPUT
   65 NS = 0                                                            BINPUT
      DO  68  I=1,NSEG                                                  BINPUT
      ISING(I) = 0                                                      BINPUT
```

```
      RW(I) = 0.0                                                      BINPUT
      IF (W(I).EQ.0.0) ISING(I) = 1                                    BINPUT
      DO 66 K=1,3                                                      BINPUT
      IF (PHI(K,I).EQ.0.0) ISING(I) = 1                                BINPUT
   66 RPHI(K,I) = 0.0                                                  BINPUT
      IF (ISING(I).EQ.1) NS = NS+1                                     BINPUT
      IF (ISING(I).EQ.1) GO TO 68                                      BINPUT
      RW(I) = G/W(I)                                                   BINPUT
      DO 67 K=1,3                                                      BINPUT
   67 RPHI(K,I) = 1.0/PHI(K,I)                                         BINPUT
   68 CONTINUE                                                         BINPUT
C                                                                      BINPUT
C     SET UP ELLIPSOID MATRIX AND INVERSE (ASSUME YAW,PITCH,ROLL = 0)  BINPUT
C     FOR 1ST NSEG ELLIPSOIDS IN BD(7-15) AND BD(16-24).               BINPUT
C                                                                      BINPUT
      DO  71  J=1,NSEG                                                 BINPUT
      DO 70 I=7,24                                                     BINPUT
   70 BD(I,J) = 0.0                                                    BINPUT
      DO 71 I=1,3                                                      BINPUT
      BD(4*I+3,J) = 1.0/BD(I,J)**2                                     BINPUT
   71 BD(4*I+12,J) = BD(I,J)**2                                        BINPUT
      RETURN                                                           BINPUT
      END                                                              BINPUT
```

```
      SUBROUTINE BLKDTA                                                 BLKDTA
C                                                   REV IV    07/23/86TWOPI
C     THIS SUBROUTINE REPLACES THE BLOCK DATA SUBPROGRAM OF PREVIOUS    BLKDTA
C     VERSIONS OF CVS-III TO INITIALIZE COMMON/CNSNTS/ IN A MANNER      BLKDTA
C     THAT IS INDEPENDENT OF THE COMPUTER SYSTEM BEING UTILIZED.        BLKDTA
C                                                                       BLKDTA
      IMPLICIT REAL*8 (A-H,O-Z)                                         BLKDTA
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         BLKDTA
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TEMPVS/ ZERO,ONE,THREE,TEN,ONE80,DMMY(35108)               80386
      DATA  UM/8H LBS     / , UT/8H SEC     / , UL/8H IN      /         BLKDTA
      ZERO  = 0.0                                                       BLKDTA
      ONE   = 1.0                                                       BLKDTA
      UNITM = UM                                                        BLKDTA
      UNITT = UT                                                        BLKDTA
      UNITL = UL                                                        BLKDTA
      G     = 386.088D0                                                 BLKDTA
      GRAVTY(1) = ZERO                                                  BLKDTA
      GRAVTY(2) = ZERO                                                  BLKDTA
      GRAVTY(3) = G                                                     BLKDTA
      THREE = 3.0                                                       BLKDTA
      TEN   = 10.0                                                      BLKDTA
      ONE80 = 180.0                                                     BLKDTA
      PI = DATAN2(ZERO,-ONE)                                            BLKDTA
      TWOPI = 2.0*PI                                                    TWOPI
      RADIAN = PI/ONE80                                                 BLKDTA
      THIRD  = ONE/THREE                                                BLKDTA
      EPS(1) = ONE/TEN                                                  BLKDTA
      DO  10  I=2,24                                                    BLKDTA
   10 EPS(I) = EPS(I-1)/TEN                                             BLKDTA
      RETURN                                                            BLKDTA
      END                                                               BLKDTA
```

```
      SUBROUTINE CFACTT(A,B,D)                                          CFACTT
C                                                   REV 03    05/31/73CFACTT
C        GIVEN 3X3 MATRIX A                                             CFACTT
C        COMPUTE B TRANSPOSE OF COFACTORS (SIGNED MINORS)               CFACTT
C        AND D THE VALUE OF THE DETERMINANT OF A.                       CFACTT
C        INVERSE OF A IS B(J,K)/D                                       CFACTT
C                                                                       CFACTT
      IMPLICIT REAL*8 (A-H,O-Z)                                         CFACTT
      DIMENSION A(3,3),B(3,3)                                           CFACTT
      M = 4                                                             CFACTT
      L = 2                                                             CFACTT
      N = 3                                                             CFACTT
      D = 0.0                                                           CFACTT
      DO 20 J=1,3                                                       CFACTT
      B(J,J) = A(L,L)*A(N,N)-A(L,N)*A(N,L)                              CFACTT
      IF (J.EQ.3) GO TO 20                                              CFACTT
      L = N                                                             CFACTT
      N = J                                                             CFACTT
      KK = J+1                                                          CFACTT
      DO 15 K=KK,3                                                      CFACTT
      M = M-1                                                           CFACTT
      B(K,J) = A(K,M)*A(M,J)-A(K,J)*A(M,M)                              CFACTT
   15 B(J,K) = A(J,M)*A(M,K)-A(J,K)*A(M,M)                              CFACTT
   20 D = D+A(1,J)*B(J,1)                                               CFACTT
      RETURN                                                            CFACTT
      END                                                               CFACTT
```

```
      SUBROUTINE CHAIN(ISKIP)                                           JDRIFT
C                                                    REV IV    07/24/86SLIP
C     COMPUTES THE LINEAR POSITION AND VELOCITY IN INERTIAL REFERENCE   CHAIN
C     OF BODY SEGMENTS FROM THOSE OF THE REFERENCE SEGMENTS             CHAIN
C     (I.E., SEGMENT NO. 1 AND EACH SEGMENT J FOR WHICH JNT(J)=0).      CHAIN
C                                                                       CHAIN
      IMPLICIT REAL*8(A-H,O-Z)                                          CHAIN
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           CHAIN
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),CHAIN
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       CHAIN
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     CHAIN
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    CHAIN
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       SLIP
     *               FE(3,30),TQE(3,30),CONST(5,30)                     SLIP
      COMMON/TEMPVS/ T1(3),T2(3),T3(3),T4(3),T5(3),T6(3),T7(3)          SLIP
     *            ,DMMY(35092)                                          80386
      DATA IFIRST/1/                                                    SLIP
      CALL ELTIME (1,11)                                                ATBIII
      IF (NJNT.EQ.0) GO TO 71                                           ATBIII
      IF(ISKIP.NE.0) CALL DRIFT                                         JDRIFT
      DO 70 J=1,NJNT                                                    ATBIII
      K = IABS(JNT(J))                                                  ATBIII
      IF (K.EQ.0) GO TO 70                                              ATBIII
      IF (ISING(J+1).LT.0) GO TO 70                                     ATBIII
C                                                                       ATBIII
C     COMPUTE SEGMENT POSITIONS BY                                      ATBIII
C      P(J+1) = P(K) + D(K)'*R(K,J) - D(J+1)'*R(J+1,J)                  ATBIII
C                                                                       ATBIII
C     COMPUTE SEGMENT VELOCITIES BY                                     ATBIII
C      V(J+1) = V(K) + D(K)'*W(K) X R(K,J) - D(J+1)'*W(J+1) X R(J+1,J)  ATBIII
C                                                                       ATBIII
      CALL CROSS (WMEG(1,K),SR(1,2*J-1),T1)                             JDRIFT
      CALL DOT31 (D(1,1,K),T1,T3)                                       ATBIII
      CALL CROSS (WMEG(1,J+1),SR(1,2*J),T2)                             ATBIII
      CALL DOT31 (D(1,1,J+1),T2,T4)                                     ATBIII
      CALL DOT31 (D(1,1,K),SR(1,2*J-1),T1)                              ATBIII
      CALL DOT31 (D(1,1,J+1),SR(1 2*J),T2)                              ATBIII
      IF (IABS(IPIN(J)).LT.5) GO TO 50                                  SLIP
      IF (IEULER(J).EQ.-1)GO TO 50                                      SLIP
      IF (IFIRST.EQ.1) GO TO 50                                         SLIP
      DO 40 I = 1,3                                                     SLIP
      T5(I) = SEGLP(I,J+1) + T2(I) - SEGLP(I,K) - T1(I)                 SLIP
   40 T6(I) = SEGLV(I,J+1) + T4(I) - SEGLV(I,K) - T3(I)                 SLIP
      CALL DOT31 (D(1,1,K),HT(1,3,2*J-1),T7)                            SLIP
      SR(4,2*J-1) = T5(1)*T7(1) + T5(2)*T7(2) + T5(3)*T7(3)             SLIP
      SR(4,2*J  ) = T6(1)*T7(1) + T6(2)*T7(2) + T6(3)*T7(3)             SLIP
      CALL CROSS (WMEG(1,K),HT(1,3,2*J-1),T5)                           SLIP
      CALL DOT31 (D(1,1,K),T5,T6)                                       SLIP
      DO 45 I =1 ,3                                                     SLIP
      T1(I) = T1(I) + SR(4,2*J-1)*T7(I)                                 SLIP
```

```
   45 T3(I) = T3(I) + SR(4,2*J  )*T7(I) + SR(4,2*J-1)*T6(I)          SLIP
   50 DO 60 I=1,3                                                      SLIP
      SEGLP(I,J+1) = SEGLP(I,K) + T1(I) - T2(I)                        ATBIII
   60 SEGLV(I,J+1) = SEGLV(I,K) + T3(I) - T4(I)                        ATBIII
   70 CONTINUE                                                         CHAIN
      IFIRST = 0                                                       SLIP
C                                                                      CHAIN
C     OPTIONAL OUTPUT                                                  CHAIN
C                                                                      CHAIN
   71 IF  (NPRT(20).NE.0)  WRITE(6,90)  TIME                           CHAIN
     *                          ,((SEGLP(I,J),I=1,3),J=1,NSEG)         CHAIN
     *                          ,((SEGLV(I,J),I=1,3),J=1,NSEG)         CHAIN
   90 FORMAT('0 LINEAR POSITIONS AND VELOCITIES OF BODY SEGMENTS FROM CHCHAIN
     *AIN FOR TIME =',F12.6/(9F13.5))                                  CHAIN
      CALL ELTIME(2,11)                                                CHAIN
      RETURN                                                           CHAIN
      END                                                              CHAIN
```

```
      SUBROUTINE CINPUT                                                  CINPUT
C                                                    REV III.2 08/08/84REVIII
C     INPUT CARDS E.1 - E.4 FOR THE FORCE-DEFLECTION, INERTIAL SPIKE,    CINPUT
C     R FACTOR, G FACTOR AND FRICTION COEFFICIENT FUNCTION DEFINITIONS   CINPUT
C                                                                        CINPUT
      IMPLICIT REAL*8(A-H,O-Z)                                           CINPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,            PAGE
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/TEMPVS/JTITLE(5,51),NF(5),NT(3),KTITLE(31),DMMY(34966)      80386
      REAL JTITLE,KTITLE                                                 CINPUT
C                                                                        CINPUT
      IS = 0                                                             CINPUT
      DO 10 I = 1,50                                                     CINPUT
   10 NTI(I) = 0                                                         CINPUT
      J1 = 1                                                             CINPUT
C                                                                        CINPUT
C     INPUT CARD E.1 - FUNCTION NO. AND TITLE, IF NO. > 50 SKIP OUT.     CINPUT
C                                                                        CINPUT
   11 READ(5,12) I,(KTITLE(J  ),J = 1,5)                                 CINPUT
   12 FORMAT (I4,4X,5A4)                                                 CINPUT
      IF (I.GT.50) GO TO 30                                              CINPUT
      DO 13 J = 1,5                                                      CINPUT
   13 JTITLE(J,I) = KTITLE(J)                                            CINPUT
C                                                                        CINPUT
C     HAS FUNCTION NO. BEEN ALREADY USED?                                CINPUT
C                                                                        CINPUT
      IF  (NTI(I).NE.0)  WRITE(6,14) I                                   CINPUT
   14 FORMAT('0 FUNCTION NO.',I4,' HAS ALREADY BEEN INPUTTED AND WILL BECINPUT
     *REPLACED BY NEXT FUNCTION')                                        CINPUT
      NTI(I) = J1                                                        CINPUT
      J2 = J1+4                                                          CINPUT
C                                                                        CINPUT
C     INPUT CARD E.2                                                     CINPUT
C                                                                        CINPUT
      READ(5,15) (TAB(J),J = J1,J2)                                      CINPUT
   15 FORMAT (6F12.0)                                                    CINPUT
      IS = 1-IS                                                          CINPUT
      IF (IS.EQ.0) WRITE(6,16)                                           CINPUT
      IF (IS.EQ.0) GOTO 40                                               PAGE
      WRITE(6,41) NPG                                                    PAGE
   41 FORMAT('1',122X,'PAGE',I5)                                         PAGE
      NPG=NPG+1                                                          PAGE
   16 FORMAT(/////)                                                      CINPUT
   40 WRITE(6,17) I,(JTITLE(J,I),J=1,5),I,NTI(I),(TAB(J),J=J1,J2)        PAGE
   17 FORMAT(' FUNCTION NO.',I4,4X,5A4,20X,'NTI(',I2,') =',I5,45X,       PAGE
     * 'CARDS E'//10X,'D0',13X,'D1',13X,'D2',13X,'D3',13X,'D4'/5F15.4//)CINPUT
      D0 = TAB(J1)                                                       CINPUT
      D1 = TAB(J1+1)                                                     CINPUT
      D2 = TAB(J1+2)                                                     CINPUT
      J1 = J2+1                                                          CINPUT
      IF (D1)  22,18,20                                                  CINPUT
```

```
C                                                                       CINPUT
C     FUNCTION IS CONSTANT  D2 FOR ALL D.                               CINPUT
C                                                                       CINPUT
   18 WRITE(6,19)  D2                                                   CINPUT
   19 FORMAT(7X,'FUNCTION IS CONSTANT',F12.6)                           CINPUT
      GO TO 11                                                          CINPUT
C                                                                       CINPUT
C       5TH ORDER POLYNOMIAL ...  1ST FUNCTION                          CINPUT
C       INPUT CARD E.3                                                  CINPUT
C                                                                       CINPUT
   20 J2 = J1+5                                                         CINPUT
      READ(5,15)(TAB(J),J = J1,J2)                                      CINPUT
      WRITE(6,21)  (TAB(J),J = J1,J2)                                   CINPUT
   21 FORMAT(7X,'FIRST PART OF FUNCTION - 5TH DEGREE POLYNOMIAL'//      CINPUT
     *         8X,'A0',13X,'A1',13X,'A2',13X,'A3',13X,'A4',13X,'A5',13X/CINPUT
     *         6F15.6//)                                                CINPUT
      J1 = J2+1                                                         CINPUT
      GO TO 25                                                          CINPUT
C                                                                       CINPUT
C         TABLE LOAD ...  1ST FUNCTION                                  CINPUT
C         INPUT CARDS E.4.A-E.4.N                                       CINPUT
C                                                                       CINPUT
   22 READ(5,23)  NPI                                                   CINPUT
   23 FORMAT (12I6)                                                     CINPUT
      TAB(J1) = NPI                                                     CINPUT
      J1 = J1+1                                                         CINPUT
      J2 = J1+2*NPI-1                                                   CINPUT
      READ(5,15)(TAB(J),J = J1,J2)                                      CINPUT
      WRITE(6,24)  NPI, (TAB(J)   ,J = J1, J2)                          CINPUT
   24 FORMAT(7X,'FIRST PART OF FUNCTION - ',I4,' TABULAR POINTS'//      CINPUT
     *         8X,'D',16X,'F(D)'  /(F15.6,F15.4))                       CINPUT
      J1 = J2+1                                                         CINPUT
C                                                                       CINPUT
C        CHECK FOR SECOND FUNCTION                                      CINPUT
C                                                                       CINPUT
   25 IF(D2)  28,11,26                                                  CINPUT
C                                                                       CINPUT
C       SECOND FUNCTION ...  5TH ORDER POLYNOMIAL                       CINPUT
C       INPUT CARD E.3                                                  CINPUT
C                                                                       CINPUT
   26 J2 = J1+5                                                         CINPUT
      READ(5,15)(TAB(J),J = J1,J2)                                      CINPUT
      WRITE(6,27)  (TAB(J),J = J1,J2)                                   CINPUT
   27 FORMAT(7X,'SECOND PART OF FUNCTION - 5TH DEGREE POLYNOMIAL'//     CINPUT
     *         8X,'B0',13X,'B1',13X,'B2',13X,'B3',13X,'B4',13X,'B5',13X/CINPUT
     *         6F15.6//)                                                CINPUT
      J1 = J2+1                                                         CINPUT
      GO TO 11                                                          CINPUT
C                                                                       CINPUT
C       SECOND FUNCTION ...  TABLE LOAD                                 CINPUT
C       INPUT CARDS E.4.A-E.4.N                                         CINPUT
C                                                                       CINPUT
```

```
28 READ(5,23)  NPI                                                        CINPUT
   TAB(J1) = NPI                                                          CINPUT
   J1 = J1+1                                                              CINPUT
   J2 = J1+2*NPI-1                                                        CINPUT
   READ(5,15)(TAB(J),J = J1,J2)                                           CINPUT
   WRITE(6,29) NPI, (TAB(J), J = J1,J2)                                   CINPUT
29 FORMAT(7X,'SECOND PART OF FUNCTION - ',I4,' TABULAR POINTS'//          CINPUT
  *         8X,'D',16X,'F(D)'  /(F15.6,F15.4))                            CINPUT
   J1 = J2+1                                                              CINPUT
   GO TO 11                                                               CINPUT
30 MXTB1 = J1-1                                                           CINPUT
   CALL KINPUT                                                            CINPUT
   CALL FINPUT                                                            CINPUT
   CALL HINPUT                                                            CINPUT
   RETURN                                                                 CINPUT
   END                                                                    CINPUT
```

```
      SUBROUTINE CMPUTE (K,M,FT)                                         CMPUTE
C                                                  REV III.2 08/08/84REVIII
      IMPLICIT REAL*8 (A-H,O-Z)                                          CMPUTE
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,            CMPUTE
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/CDINT/ UU(4),GH(3,4),                                       CMPUTE
     *              E(3,240), F(5,240),GG(5,240),Y(5,240),U(5,240),      CMPUTE
     *              H,HPRINT,HS,TPRINT,TSTART,ICNT,IDBL,IFLAG,IDMMY      80386
      COMMON/COMAIN/ VAR(240),DER(240),DT,HO,HMAX,HMIN,RSTIME,           CMPUTE
     *               ISTEP,NSTEPS,NDINT,NEQ,IRSIN,IRSOUT                 CMPUTE
      TIME = TSTART + FT                                                 CMPUTE
      CALL DZP (NEQ,VAR,GG,E,FT,M)                                       CMPUTE
      IF  (NPRT(26).EQ.2)  CALL OUTPUT(0)                                CMPUTE
      CALL PDAUX (VAR,DER,NEQ,K)                                         CMPUTE
      IF  (NPRT(26).EQ.2)  CALL OUTPUT(1)                                CMPUTE
      RETURN                                                             CMPUTE
      END                                                                CMPUTE
```

```
      SUBROUTINE CONTCT                                                 CONTCT
C                                                   REV III.2 08/08/84REVIII
C     CONTROLS THE CALLING OF SUBROUTINES REQUIRED TO COMPUTE THOSE     CONTCT
C     EXTERNAL FORCES AND TORQUES ACTING ON THE BODY SEGMENTS.          CONTCT
C                                                                       CONTCT
      IMPLICIT REAL*8 (A-H,O-Z)                                         CONTCT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           CONTCT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), CONTCT
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), CONTCT
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               CONTCT
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         CONTCT
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       CONTCT
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          CONTCT
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         CONTCT
      COMMON/WINDFR/ WTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),    WINDOP
     *               MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)       WINDOP
      DATA MAXPSF/70/,MAXBSF/20/,MAXSSF/46/                             NCFORC
C                                                                       CHGIII
C     MAXSSF SHOULD BE 40 BUT IT IS ALLOWED TO OVERFLOW INTO BAGSF      NCFORC
C                                                                       CHGIII
      CALL ELTIME(1,12)                                                 CONTCT
      NPSF - 0                                                          CONTCT
      NBSF - 0                                                          CONTCT
      NSSF - 0                                                          CONTCT
      IF (NPL.LE.0) GO TO 21                                            CONTCT
C                                                                       CONTCT
C     CALL PLELP ROUTINE FOR EACH ALLOWED PLANE-SEGMENT CONTACT.        CONTCT
C                                                                       CONTCT
      DO 20 J-1,NPL                                                     CONTCT
      IF(MNPL(J).EQ.0) GO TO 20                                         CONTCT
      KPL - MNPL(J)                                                     CONTCT
      DO 19 I-1,KPL                                                     CONTCT
      NPSF - NPSF+1                                                     CONTCT
      IF(NPSF.GT.MAXPSF) STOP 57                                        CHGIII
      M1 - MPL(1,I,J)                                                   CONTCT
      M2 - MPL(2,I,J)                                                   CONTCT
      M3 - MPL(3,I,J)                                                   CONTCT
      NT - NTPL(I,J)                                                    CONTCT
      JT - NTAB(NT)                                                     CONTCT
      TAB(JT) - 0.0                                                     CONTCT
   19 CALL PLELP(M2,M3,M1,J,NT)                                         CONTCT
   20 CONTINUE                                                          CONTCT
   21 IF(NBLT.LE.0) GO TO 41                                            CONTCT
C                                                                       CONTCT
C     CALL BELTRT ROUTINE FOR EACH ALLOWED BELT-SEGMENT CONTACT.        CONTCT
C                                                                       CONTCT
      DO 30 J-1,NBLT                                                    CONTCT
      IF(MNBLT(J).EQ.0) GO TO 30                                        CONTCT
      KBLT - MNBLT(J)                                                   CONTCT
```

```
      DO 29 I=1,KBLT                                                   CONTCT
      NBSF = NBSF+1                                                    CONTCT
      IF(NBSF.GT.MAXBSF) STOP 58                                       CHGIII
      M1 = MBLT(1,I,J)                                                 CONTCT
      M2 = MBLT(2,I,J)                                                 CONTCT
      M3 = MBLT(3,I,J)                                                 CONTCT
      NT = NTBLT(I,J)                                                  CONTCT
      JT = NTAB(NT)                                                    CONTCT
      TAB(JT) = 0.0                                                    CONTCT
      NF = NTAB(NT+5)                                                  CONTCT
      IF (NF.NE.0) JT = NTAB(NT+6)                                     CONTCT
      IF (NF.NE.0) TAB(JT) = 0.0                                       CONTCT
   29 CALL BELTRT(M2,M3,M1,J,NT)                                       CONTCT
   30 CONTINUE                                                         CONTCT
C                                                                      CONTCT
C     CALL SEGSEG ROUTINE FOR EACH ALLOWED SEGMENT-SEGMENT CONTACT.    CONTCT
C                                                                      CONTCT
   41 DO 50 J=1,NSEG                                                   CONTCT
      IF(MNSEG(J).EQ.0) GO TO 50                                       CONTCT
      KSEG = MNSEG(J)                                                  CONTCT
      DO 49 I=1,KSEG                                                   CONTCT
      NSSF = NSSF+1                                                    CONTCT
      IF(NSSF.GT.MAXSSF) STOP 59                                       CHGIII
      M1 = MSEG(1,I,J)                                                 CONTCT
      M2 = MSEG(2,I,J)                                                 CONTCT
      M3 = MSEG(3,I,J)                                                 CONTCT
      NT = NTSEG(I,J)                                                  CONTCT
      JT = NTAB(NT)                                                    CONTCT
      TAB(JT) = 0.0                                                    CONTCT
   49 CALL SEGSEG(J,M1,M2,M3,NT)                                       CONTCT
   50 CONTINUE                                                         CONTCT
C                                                                      CONTCT
C     CALL AIRBAG ROUTINE FOR ALLOWED BAG-SEGMENT CONTACTS, IF ANY.    CONTCT
C                                                                      CONTCT
      IF (NBAG.NE.0) CALL AIRBAG                                       CONTCT
C                                                                      CONTCT
C     CALL WINDY ROUTINE FOR WIND FORCES ON EACH SEGMENT.              CONTCT
C                                                                      CONTCT
      DO 60 J=1,NSEG                                                   CONTCT
      IF (MWSEG(1,J).EQ.0) GO TO 60                                    CONTCT
      M=MWSEG(1,J)                                                     WINDOP
      M1 = MWSEG(2,J)                                                  CONTCT
      M2 = MWSEG(3,J)                                                  CONTCT
      M3 = MWSEG(4,J)                                                  CONTCT
      NT = MWSEG(5,J)                                                  CONTCT
      CALL WINDY (M,M1,M2,M3,NT)                                       WINDOP
   60 CONTINUE                                                         CONTCT
C                                                                      CONTCT
C     CALL WINDY FOR FORCE FUNCE FUNCTION CALCULATIONS.                CONTCT
C                                                                      CONTCT
      NFORCE = NFVSEG(6)                                               CONTCT
      IF  (NFORCE.GT.0)  CALL WINDY (0,M1,M2,M3,NT)                    WINDOP
```

```
C                                                                       CONTCT
C     CALL HBELT ROUTINE FOR EACH HARNESS-BELT SYSTEM.                  CONTCT
C                                                                       CONTCT
      IF  (NHRNSS.LE.0)  GO TO 80                                       CONTCT
      J1 = 1                                                            CONTCT
      KNLO = 0                                                          CONTCT
      DO  70  I=1,NHRNSS                                                CONTCT
      IF  (NBLTPH(I).LE.0)  GO TO 70                                    CONTCT
      J2 = J1 + NBLTPH(I) - 1                                           CONTCT
      CALL HBELT (J1,J2,KNLO,0)                                         CONTCT
      J1 = J2+1                                                         CONTCT
   70 CONTINUE                                                          CONTCT
C                                                                       CONTCT
C     CALL SPDAMP FOR SPRING DAMPER FORCES, IF ANY                      CONTCT
C                                                                       CONTCT
   80 IF  (NSD.NE.0)  CALL SPDAMP                                       CONTCT
      CALL ELTIME (2,12)                                                CONTCT
      RETURN                                                            CONTCT
      END                                                               CONTCT
```

```
      SUBROUTINE CROSS(A,B,C)                                           CROSS
C                                                      REV 03     05/31/73CROSS
C     COMPUTES VECTOR CROSS PRODUCT  C = A X B.                         CROSS
C                                                                       CROSS
C       ARGUMENTS                                                       CROSS
C         A,B,C: VECTORS OF LENGTH 3 WHERE C=AXB.                       CROSS
C                                                                       CROSS
      IMPLICIT REAL*8 (A-H,O-Z)                                         CROSS
      DIMENSION A(3),B(3),C(3)                                          CROSS
       C(1) = A(2)*B(3) - A(3)*B(2)                                     CROSS
       C(2) = A(3)*B(1) - A(1)*B(3)                                     CROSS
       C(3) = A(1)*B(2) - A(2)*B(1)                                     CROSS
      RETURN                                                            CROSS
      END                                                               CROSS
```

```
      SUBROUTINE DAUX(I1)                                               DAUX
C                                                    REV IV   07/24/86SLIP
C     COMPUTES DERIVATIVES FOR INTEGRATOR ROUTINE BY                    DAUX
C      (1) SET UP INITIAL VALUES FOR ARRAY OF SYSTEM EQUATIONS.         DAUX
C      (2) MODIFY ARRAYS BY CONSTRAINTS.                                DAUX
C      (3) SOLVE SYSTEM OF EQUATION FOR F,TQ,QQ AND V4.                 DAUX
C      (4) EVALUATE DERIVATIVES SEGLA AND WMEGD.                        DAUX
C                                                                       DAUX
      IMPLICIT REAL*8(A-H,O-Z)                                          DAUX
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DAUX
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DAUX
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DAUX
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DAUX
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DAUX
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   DAUX
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),DAUX
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              DAUX
     *               KQ1(12),KQ2(12),KQTYPE(12)                         DAUX
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          DAUX
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DAUX
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
C                                                                       DAUX
C     NOTE: DAUX SHARES /TEMPVS/ WITH DAUX11,12,22,31,32 &33.           DAUX
C                                                                       DAUX
      LOGICAL*1 FREE,LDMMY                                              80386
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S,           SLIP
     *               IDUM(458),FREE(30),LDMMY(2),DMMY(27859)            80386
      DIMENSION T1(3),T2(3),T3(3)                                       TGMOD2
      CALL ELTIME(1,9)                                                  DAUX
C                                                                       DAUX
C     IF I1#0, U1 AND U2 HAVE BEEN SET UP BY CALLING ROUTINE.           DAUX
C                                                                       DAUX
      IF (I1.NE.0) GO TO  8                                             DAUX
C                                                                       DAUX
C     SET UP INITIAL VALUES OF A & B ARRAYS AND U & V VECTORS.          DAUX
C     MODIFY U1 & U2 ARRAYS BY CONTACT AND JOINT FORCES.                DAUX
C                                                                       DAUX
      CALL CHAIN(NPRT(36))                                              JDRIFT
      CALL SETUP1                                                       DAUX
      CALL VEHPOS                                                       DAUX
      CALL CONTCT                                                       DAUX
      CALL VISPR(0,0)                                                   DAUX
      CALL EJOINT(0,0)                                                  DAUX
      CALL SETUP2                                                       DAUX
      IF (NFLX.GT.0) CALL FLXSEG                                        DAUX
C                                                                       DAUX
```

```
C     MODIFY U1,U2 AND ADD G TO U1.                                      DAUX
C                                                                        DAUX
      DO  5  J=1,NGRND                                                   DAUX
      IF  (ISING(J))  1,3,5                                              DAUX
    1 DO  2  I=1,3                                                       DAUX
      U1(I,J) = SEGLA(I,J)                                               DAUX
    2 U2(I,J) = WMEGD(I,J)                                               DAUX
      GO TO 5                                                            DAUX
    3 DO  4  I=1,3                                                       DAUX
      U1(I,J) = U1(I,J)*RW(J) + GRAVTY(I)                                DAUX
    4 U2(I,J) = U2(I,J)*RPHI(I,J)                                        DAUX
    5 CONTINUE                                                           DAUX
C                                                                        DAUX
C     SET UP BODY SEGMENT SYMMETRY                                       DAUX
C         NSYM(J) = 0    3D MOTION                                       DAUX
C         NSYM(J) = J    CENTRAL SEGMENT 2D MOTION, NO LATERAL MOTION    DAUX
C         NSYM(J) = K    SEGMENT J SYMMETRIC TO SEGMENT K, ALL MOTION    DAUX
C                        IN THE X-Z PLANE, NO LATERAL MOTION             DAUX
C         NSYM(J) = -K   SEGMENT J MIRROR SYMMETRIC TO SEGMENT K, EQUAL  DAUX
C                        BUT OPPOSITE LATERAL MOTION PERMITTED           DAUX
C                                                                        DAUX
      DO  20  J=1,NGRND                                                  DAUX
      IF (NSYM(J).EQ.0) GO TO 20                                         DAUX
      K = IABS(NSYM(J))                                                  DAUX
      DO 205 L=1,3                                                       TGMOD2
      T1(L) = U2(L,J)                                                    TGMOD2
      T2(L) = U2(L,K)                                                    TGMOD2
      T3(L) = U2(L,J)                                                    TGMOD2
  205 CONTINUE                                                           TGMOD2
      IF(LPMI(J).EQ.0.AND.LPMI(K).EQ.0) GO TO 201                        TGMOD2
      IF(LPMI(J).NE.0.AND.LPMI(K).EQ.0) GO TO 202                        TGMOD2
      IF(LPMI(J).EQ.0.AND.LPMI(K).NE.0) GO TO 203                        TGMOD2
      CALL DOT31(DPMI(1,1,J),U2(1,J),T1)                                 TGMOD2
      CALL DOT31(DPMI(1,1,K),U2(1,K),T2)                                 TGMOD2
      GO TO 201                                                          TGMOD2
  202 CALL DOT31(DPMI(1,1,J),U2(1,J),T1)                                 TGMOD2
      GO TO 201                                                          TGMOD2
  203 CALL DOT31(DPMI(1,1,K),U2(1,K),T2)                                 TGMOD2
  201 CONTINUE                                                           TGMOD2
      IF (NSYM(J).EQ.J) GO TO 19                                         DAUX
      IF (K.LT.J) GO TO 16                                               DAUX
      U1(1,J) = 0.5*(U1(1,J) + U1(1,K))                                  DAUX
      U1(3,J) = 0.5*(U1(3,J) + U1(3,K))                                  DAUX
      T3(2) = 0.5*(T1(2) + T2(2))                                        TGMOD2
      GO TO 17                                                           DAUX
   16 U1(1,J) = U1(1,K)                                                  DAUX
      U1(3,J) = U1(3,K)                                                  DAUX
      T3(2) = T2(2)                                                      DAUX
   17 IF (NSYM(J).GT.0) GO TO 19                                         DAUX
      IF (K.LT.J) GO TO 18                                               DAUX
      U1(2,J) = 0.5*(U1(2,J) - U1(2,K))                                  DAUX
      T3(1) = 0.5*(T1(1) - T2(1))                                        TGMOD2
```

```
      T3(3) = 0.5*(T1(3) - T2(3))                                       TGMOD2
      GO TO 206                                                         DAUX
   18 U1(2,J) = -U1(2,K)                                                DAUX
      T3(1) = -T2(1)                                                    TGMOD2
      T3(3) = -T2(3)                                                    TGMOD2
      GO TO 206                                                         DAUX
   19 U1(2,J) = 0.0                                                     DAUX
      T3(1) = 0.0                                                       TGMOD2
      T3(3) = 0.0                                                       TGMOD2
  206 IF(LPMI(J).EQ.0) GO TO 207                                        TGMOD2
      CALL MAT31(DPMI(1,1,J),T3,U2(1,J))                                TGMOD2
      GO TO 20                                                          TGMOD2
  207 U2(1,J) = T3(1)                                                   TGMOD2
      U2(2,J) = T3(2)                                                   TGMOD2
      U2(3,J) = T3(3)                                                   TGMOD2
   20 CONTINUE                                                          TGMOD2
C                                                                       DAUX
C     INITIALIZE IJK ARRAY AND IJ COUNTER TO ZERO.                      DAUX
C                                                                       DAUX
    8 NQ2S = 2*NS + NFLX + NQ                                           DAUX
      NJ2  = NQ2S + 2*NJNT                                              DAUX
      IF (NJ2.GT.54) WRITE (6,11) NS,NFLX,NQ,NJNT,NJ2                   DAUX
   11 FORMAT('ONS=',I6,',NFLX=',I6,',NQ=',I6,',NJNT=',I6,' AND NJ2=',I6/AFREVS
     *' THE VALUE OF NJ2 EXCEEDS THE ARRAY SIZES FOR RHS AND IJK IN SUBRDAUX
     *OUTINE DAUX. PROGRAM TERMINATED.')                                DAUX
      IF  (NJ2.GT.54)  STOP 34                                          DAUX
      MJ2 = NJ2                                                         DAUX
      DO 10 I=1,NJ2                                                     DAUX
      DO 10 J=1,NJ2                                                     DAUX
   10 IJK(I,J) = 0                                                      DAUX
      IJ = 0                                                            DAUX
C                                                                       DAUX
C     ELMINATE SEGLA AND WMEGD FROM SYSTEM OF EQUATIONS.                DAUX
C                                                                       DAUX
      IF (NS.GT.0)   CALL DAUX55                                        DAUX
      IF (NJNT.EQ.0) GO TO 12                                           DAUX
      IF (NFLX.GT.0) CALL DAUX44                                        DAUX
      CALL DAUX11                                                       DAUX
      CALL DAUX12                                                       DAUX
      CALL DAUX22                                                       DAUX
   12 IF (NQ.LE.0) GO TO 15                                             DAUX
      IF (NJNT.EQ.0) GO TO 13                                           DAUX
      CALL DAUX31                                                       DAUX
      CALL DAUX32                                                       DAUX
   13 CALL DAUX33                                                       DAUX
      DO 14 I=1,NQ                                                      DAUX
   14 IF (KQTYPE(I).GE.4) MJ2 = -NJ2                                    DAUX
   15 IF (NPRT(8).EQ.0) GO TO 28                                        DAUX
   21 WRITE (6,22) NPG,(J,J=1,NJ2)                                      PAGE
      NPG=NPG+1                                                         PAGE
   22 FORMAT('1 DAUX PRINT OF IJK MATRIX',97X,'PAGE',I5//6X,40I3)       PAGE
      DO 23 I=1,NJ2                                                     DAUX
```

```
   23 WRITE (6,24) I,(IJK(I,J),J=1,NJ2)                                DAUX
   24 FORMAT(I3,3X,40I3)                                               DAUX
      WRITE (6,29)                                                     DAUX
   29 FORMAT('0 DAUX PRINT OF RHS ARRAY'//)                            DAUX
      DO 30 K=1,NJ2                                                    DAUX
   30 WRITE (6,27) K,(RHS(I,K),I=1,3)                                  DAUX
      WRITE (6,25) NPG                                                 PAGE
      NPG=NPG+1                                                        PAGE
   25 FORMAT('1 DAUX PRINT OF C ARRAY ELEMENTS',91X,'PAGE',I5//)       PAGE
      DO 26 K=1,IJ                                                     DAUX
   26 WRITE (6,27) K,((C(I,J,K),J=1,3),I=1,3)                          DAUX
   27 FORMAT(I6,9G14.7)                                                DAUX
   28 IF (NPRT(8).EQ.-2) GO TO 31                                      DAUX
C                                                                      DAUX
C     SOLVE SYSTEM OF EQUATIONS FOR F.TQ,QQ & V4.                      DAUX
C                                                                      DAUX
      CALL FSMSOL (C,RHS,IJK,MJ2,IJ,54,600)                            CHGIII
      IF (NPRT(8).EQ. 2) NPRT(8) = -2                                  DAUX
      IF (NPRT(8).EQ.-2) GO TO 21                                      DAUX
   31 IF (NPRT(8).EQ.-2) NPRT(8) = 0                                   DAUX
      EPS12 = EPS(12)                                                  JDRIFT
      IF (NJNT.EQ.0) GO TO 49                                          DAUX
      DO 51 I=1,NJNT                                                   DAUX
      NJ = NQ2S + I                                                    DAUX
      NI = NJ+NJNT                                                     DAUX
      DO 51 K=1,3                                                      DAUX
      IF (DABS(RHS(K,NJ)).LT.EPS12) RHS(K,NJ) = 0.0                    DAUX
      IF (DABS(RHS(K,NI)).LT.EPS12) RHS(K,NI) = 0.0                    DAUX
      TQ(K,I) = TQ(K,I) - RHS(K,NI)                                    DAUX
   51 F(K,I) = RHS(K,NJ)                                               DAUX
   49 IF (NQ.EQ.0) GO TO 53                                            DAUX
      DO 52 I=1,NQ                                                     DAUX
      J = 2*NS + NFLX + I                                              DAUX
      DO 52 K=1,3                                                      DAUX
      IF (KQTYPE(I).LT.0)           RHS(K,J) = 0.0                     DAUX
      IF (DABS(RHS(K,J)).LT.EPS12) RHS(K,J) = 0.0                      DAUX
   52 QQ(K,I) = RHS(K,J)                                               DAUX
   53 IF (NFLX.EQ.0) GO TO 70                                          DAUX
      DO 54 I=1,NFLX                                                   DAUX
      J = 2*NS + I                                                     DAUX
      DO 54 K=1,3                                                      DAUX
      IF (DABS(RHS(K,J)).LT.EPS12) RHS(K,J) = 0.0                      DAUX
   54 V4(K,I) = RHS(K,J)                                               DAUX
C                                                                      DAUX
C     BACKUP SOLUTION FOR SEGLA AND WMEGD.                             DAUX
C                                                                      DAUX
   70 DO  71  J=1,NGRND                                                DAUX
      DO  71  I=1,3                                                    DAUX
      SEGLA(I,J) = U1(I,J)                                             DAUX
   71 WMEGD(I,J) = U2(I,J)                                             DAUX
      IF (NS.EQ.0) GO TO 79                                            DAUX
C                                                                      DAUX
```

```
C     SET UP SEGLA & WMEGD FOR SINGULAR SEGMENTS.                       DAUX
C                                                                       DAUX
      IS = 0                                                            DAUX
      DO 78 J=1,NGRND                                                   DAUX
      IF (ISING(J).LE.0) GO TO 78                                       DAUX
      IS = IS+2                                                         DAUX
      DO 77 I=1,3                                                       DAUX
      IF (DABS(RHS(I,IS-1)).LT.EPS12) RHS(I,IS-1) = 0.0                 DAUX
      SEGLA(I,J) = SEGLA(I,J) + RHS(I,IS-1)                             DAUX
      IF (DABS(RHS(I,IS  )).LT.EPS12) RHS(I,IS  ) = 0.0                 DAUX
   77 WMEGD(I,J) = WMEGD(I,J) + RHS(I,IS)                               DAUX
   78 CONTINUE                                                          DAUX
   79 IF (NJNT.EQ.0) GO TO 80                                           DAUX
C                                                                       DAUX
C     ELIMINATE F                                                       DAUX
C                                                                       DAUX
      DO 75 M=1,NJNT                                                    DAUX
      N = IABS(JNT(M))                                                  DAUX
      IF (N.EQ.0) GO TO 73                                              DAUX
      DO 72 I=1,3                                                       DAUX
      DO 72 J=1,3                                                       DAUX
      SEGLA(I,N  ) = SEGLA(I,N  ) - A11(I,J,M)*RW(N  )*F(J,M)           SLIP
      SEGLA(I,M+1) = SEGLA(I,M+1) + A1[illegible]I,M)*RW(M+1)*F(J,M)    SLIP
      WMEGD(I,N)   = WMEGD(I,N  ) - B1[illegible],2*M-1)*RPHI(I,N  )*F(J,M) DAUX
   72 WMEGD(I,M+1) = WMEGD(I,M+1) - B12(J,I,2*M  )*RPHI(I,M+1)*F(J,M)   DAUX
C                                                                       DAUX
C     ELIMINATE TQ                                                      DAUX
C                                                                       DAUX
   73 IF (FREE(M)) GO TO 75                                             SLIP
      L = NQ2S + NJNT + M                                               DAUX
      DO 74 I=1,3                                                       DAUX
      DO 74 J=1,3                                                       DAUX
      WMEGD(I,N  ) = WMEGD(I,N  ) - A22(I,J,2*M-1)*RPHI(I,N  )*RHS(J,L) DAUX
   74 WMEGD(I,M+1) = WMEGD(I,M+1) + A22(I,J,2*M  )*RPHI(I,M+1)*RHS(J,L) DAUX
   75 CONTINUE                                                          DAUX
   80 IF (NQ.EQ.0) GO TO 83                                             DAUX
C                                                                       DAUX
C     ELIMINATE QQ                                                      DAUX
C                                                                       DAUX
      DO 82 K=1,NQ                                                      DAUX
      IF (KQTYPE(K).LT.0) GO TO 82                                      DAUX
      N = KQ1(K)                                                        DAUX
      M = KQ2(K)                                                        DAUX
      DO 81 I=1,3                                                       DAUX
      DO 81 J=1,3                                                       DAUX
      SEGLA(I,N) = SEGLA(I,N) - A13(I,J,2*K-1)*RW(N)    *QQ(J,K)        DAUX
      SEGLA(I,M) = SEGLA(I,M) - A13(I,J,2*K  )*RW(M)    *QQ(J,K)        DAUX
      WMEGD(I,N) = WMEGD(I,N) - A23(I,J,2*K-1)*RPHI(I,N)*QQ(J,K)        DAUX
   81 WMEGD(I,M) = WMEGD(I,M) - A23(I,J,2*K  )*RPHI(I,M)*QQ(J,K)        DAUX
   82 CONTINUE                                                          DAUX
   83 IF (NFLX.EQ.0) GO TO 90                                           DAUX
C                                                                       DAUX
```

```
C     ELIMINATE V4 (TORQUES FOR FLEXIBLE SEGMENTS)                      DAUX
C                                                                       DAUX
      DO 84 N=1,NFLX                                                    DAUX
      N1 = NFLEX(1,N)                                                   DAUX
      N2 = NFLEX(2,N)                                                   DAUX
      N3 = NFLEX(3,N)                                                   DAUX
      DO 84 I=1,3                                                       DAUX
      DO 84 J=1,3                                                       DAUX
      WMEGD(I,N1) = WMEGD(I,N1) - B42(J,I,3*N-2)*RPHI(I,N1)*V4(J,N)     DAUX
      WMEGD(I,N2) = WMEGD(I,N2) - B42(J,I,3*N-1)*RPHI(I,N2)*V4(J,N)     DAUX
   84 WMEGD(I,N3) = WMEGD(I,N3) - B42(J,I,3*N  )*RPHI(I,N3)*V4(J,N)     DAUX
   90 DO 91 J=1,NGRND                                                   DAUX
      DO 91 I=1,3                                                       DAUX
      IF (DABS(WMEGD(I,J)).LE.EPS12) WMEGD(I,J) = 0.0                   DAUX
   91 IF (DABS(SEGLA(I,J)).LE.EPS12) SEGLA(I,J) = 0.0                   DAUX
C                                                                       DAUX
C     OPTIONAL OUTPUT OF FUNCTIONS AND DERIVATIVES.                     DAUX
C                                                                       DAUX
      IF (NPRT(9).NE.0) CALL PRINT(6H DAUX )                            DAUX
C                                                                       DAUX
      CALL ELTIME(2,9)                                                  DAUX
      RETURN                                                            DAUX
      END                                                               DAUX
```

```
      SUBROUTINE DAUX11                                                 DAUX11
C                                                    REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE DAUX TO COMPUTE                              DAUX11
C                                                                       DAUX11
C                          -1                   -1                      DAUX11
C         (C11) = (B11)(M)   (A11) + (B12)(PHI)   (A21)                 DAUX11
C                                                                       DAUX11
C                         -1                  -1                        DAUX11
C         (R1) = (B11)(M)   (U1) + (B12)(PHI)   (U2) - (V1)             DAUX11
C                                                                       DAUX11
      IMPLICIT REAL*8(A-H,O-Z)                                          DAUX11
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DAUX11
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DAUX11
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DAUX11
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DAUX11
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DAUX11
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX11
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S            CHGIII
     *              ,DN(3,3),DM(3,3),SN(3,3),SM(3,3),HH(3,3),BN(3)      DAUX11
     *            ,DMMY(28044)                                          80386
      CALL ELTIME(1,14)                                                 DAUX11
      DO 30 M=1,NJNT                                                    DAUX11
      N = IABS(JNT(M))                                                  DAUX11
      MQ = NQ2S + M                                                     DAUX11
      IJ = IJ+1                                                         DAUX11
      IJK(MQ,MQ) = IJ                                                   DAUX11
      IF (N.GT.0) GO TO 13                                              DAUX11
C                                                                       DAUX11
C     IF (N < 1)  SET  C11(M,M) = I                                     DAUX11
C                                                                       DAUX11
C                 AND  RHS(M)   = V1(M)                                 DAUX11
C                                                                       DAUX11
      DO 12 I=1,3                                                       DAUX11
      DO 11 J=1,3                                                       DAUX11
   11 C(I,J,IJ) = 0.0                                                   DAUX11
      C(I,I,IJ) = 1.0                                                   DAUX11
   12 RHS(I,MQ) = V1(I,M)                                               DAUX11
      IJK(MQ,MQ) = -IJ                                                  DAUX11
      GO TO 30                                                          DAUX11
C                                                                       DAUX11
C     IF (N > 0)  SET  RHS(M)   = U1(N) - U1(M+1) - V1(M)               DAUX11
C                               + B12(M,N)U2(N) + B12(M,M+1)U2(M+1)     DAUX11
C                                                                       DAUX11
C                 AND  C11(M,N) = RW(N) + RW(M+1)                       DAUX11
C                               + B12(M,N  )PHI(N  )'A21(N  ,M)         DAUX11
C                               + B12(M,M+1)PHI(M+1)'A21(M+1,M)         DAUX11
C                                                                       DAUX11
   13 DO 15 I=1,3                                                       DAUX11
      T1 = -V1(I,M)                                                     SLIP
```

```
      DO 15 J = 1,3                                                     DAUX11
      T1 = T1 + B12(I,J,2*M-1)*U2(J,N) + B12(I,J,2*M)*U2(J,M+1)         DAUX11
     *        + A11(I,J,M)*(U1(J,N) - U1(J,M+1))                        SLIP
      IF (J.LT.I) GO TO 15                                              DAUX11
      T2 = 0.0                                                          DAUX11
      IF (J.EQ.I) T2 = RW(N) + RW(M+1)                                  DAUX11
      DO 14 K=1,3                                                       DAUX11
   14 T2 = T2 + B12(I,K,2*M-1)*RPHI(K,N  )*B12(J,K,2*M-1)               DAUX11
     *        + B12(I,K,2*M  )*RPHI(K,M+1)*B12(J,K,2*M  )               DAUX11
      C(I,J,IJ) = T2                                                    DAUX11
      C(J,I,IJ) = T2                                                    DAUX11
   15 RHS(I,MQ) = T1                                                    DAUX11
      IF  (ISING(N).NE.0)  GO TO 30                                     DAUX11
      L = 0                                                             DAUX11
      IF (N.GT.1) L = IABS(JNT(N-1))                                    DAUX11
      IF (L.EQ.0) GO TO 18                                              DAUX11
C                                                                       DAUX11
C     IF (N > 1) AND (L = JNT(N-1) > 0)                                 DAUX11
C                                                                       DAUX11
C         SET  C11(M,N-1) =  -RW(N) + B12(M,N)PHI(N)'A21(N,N-1)         DAUX11
C                                                                       DAUX11
C                                      T                                DAUX11
C         AND  C11(N-1,M) = C(M,N-1)                                    DAUX11
C                                                                       DAUX11
      KJNT = NQ2S + N -1                                                DAUX11
      IJ = IJ+1                                                         DAUX11
      IJK(MQ,KJNT) = IJ                                                 DAUX11
      IJK(KJNT,MQ) = IJ+1                                               DAUX11
      DO 17 I=1,3                                                       DAUX11
      DO 17 J=1,3                                                       DAUX11
      C(I,J,IJ) = 0.0                                                   DAUX11
      DO 16 K=1,3                                                       DAUX11
   16 C(I,J,IJ) = C(I,J,IJ) + B12(I,K,2*M-1)*RPHI(K,N)*B12(J,K,2*N-2)   DAUX11
     *                       - A11(I,K,M)*RW(N)*A11(J,K,N-1)            SLIP
   17 C(J,I,IJ+1) = C(I,J,IJ)                                           DAUX11
      IJ = IJ+1                                                         DAUX11
   18 IF (M.EQ.NJNT) GO TO 30                                           DAUX11
      M1 = M+1                                                          DAUX11
      DO 21 L=M1,NJNT                                                   DAUX11
      IF (IABS(JNT(L)).NE.N) GO TO 21                                   DAUX11
C                                                                       DAUX11
C     IF (L > M) AND (JNT(L) = N)                                       DAUX11
C                                                                       DAUX11
C         SET  C11(M,L) = RW(N) + B12(M,N)PHI(N)'A21(N,L)               DAUX11
C                                                                       DAUX11
C                                     T                                 DAUX11
C         AND  C11(L,M) = C11(M,L)                                      DAUX11
C                                                                       DAUX11
      KJNT = NQ2S + L                                                   DAUX11
      IJ = IJ+1                                                         DAUX11
      IJK(MQ,KJNT) = IJ                                                 DAUX11
      IJK(KJNT,MQ) = IJ+1                                               DAUX11
```

```
      DO 20 I=1,3                                                           DAUX11
      DO 20 J=1,3                                                           DAUX11
      C(I,J,IJ) = 0.0                                                       DAUX11
      DO 19 K=1,3                                                           DAUX11
   19 C(I,J,IJ) = C(I,J,IJ) + B12(I,K,2*M-1)*RPHI(K,N)*B12(J,K,2*L-1)      DAUX11
     *                      + A11(I,K,M)*RW(N)*A11(J,K,L)                  SLIP
   20 C(J,I,IJ+1) = C(I,J,IJ)                                               DAUX11
      IJ = IJ+1                                                             DAUX11
   21 CONTINUE                                                              DAUX11
   30 CONTINUE                                                              DAUX11
      CALL ELTIME(2,14)                                                     DAUX11
      RETURN                                                                DAUX11
      END                                                                   DAUX11
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```
      SUBROUTINE DAUX12                                                 DAUX12
C                                                REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE DAUX TO COMPUTE                              DAUX12
C                                                                       DAUX12
C                               -1                                      DAUX12
C         (C12) = (B12)(PHI)   (A22)                                    DAUX12
C                                                                       DAUX12
C                          T                                            DAUX12
C         (C21) = (C12)                                                 DAUX12
C                                                                       DAUX12
      IMPLICIT REAL*8(A-H,O-Z)                                          DAUX12
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DAUX12
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DAUX12
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DAUX12
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX12
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      LOGICAL*1 FREE,LDMMY                                              80386
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S            CHGIII
     *              ,DN(3,3),DM(3,3),SN(3,3),SM(3,3),HH(3,3),BN(3)      DAUX12
     *              ,IDUM(362),FREE(30),LDMMY(2),DMMY(27859)            80386
      CALL ELTIME(1,15)                                                 DAUX12
      NQSJNT = NQ2S + NJNT                                              DAUX12
      DO 60 M=1,NJNT                                                    DAUX12
      N = IABS(JNT(M))                                                  DAUX12
      IF (N.EQ.0) GO TO 60                                              DAUX12
      MQ = NQ2S + M                                                     DAUX12
      IF (FREE(M)) GO TO 37                                             SLIP
      MJNT = NQSJNT + M                                                 DAUX12
      IJ = IJ+1                                                         DAUX12
      IJK(MQ,MJNT) = IJ                                                 DAUX12
      IJK(MJNT,MQ) = IJ+1                                               DAUX12
      DO 36 I=1,3                                                       DAUX12
      DO 36 J=1,3                                                       DAUX12
      SN(I,J) = 0.0                                                     DAUX12
      SM(I,J) = 0.0                                                     DAUX12
      DO 35 K=1,3                                                       DAUX12
      SN(I,J) = SN(I,J) + B12(I,K,2*M-1) * RPHI(K,N  ) * A22(K,J,2*M-1) DAUX12
   35 SM(I,J) = SM(I,J) + B12(I,K,2*M  ) * RPHI(K,M+1) * A22(K,J,2*M  ) DAUX12
      C(I,J,IJ  ) = SN(I,J) - SM(I,J)                                   DAUX12
   36 C(J,I,IJ+1) = C(I,J,IJ)                                           DAUX12
      IJ = IJ+1                                                         DAUX12
   37 IF  (ISING(N).NE.0)  GO TO 50                                     DAUX12
      IF  (N.EQ.1)  GO TO 43                                            DAUX12
      IF (FREE(N-1)) GO TO 43                                           SLIP
      MJNT = NQSJNT + N-1                                               DAUX12
      IJ = IJ+1                                                         DAUX12
      IJK(MQ,MJNT) = IJ                                                 DAUX12
      IJK(MJNT,MQ) = IJ+1                                               DAUX12
      DO 42 I=1,3                                                       DAUX12
      DO 42 J=1,3                                                       DAUX12
```

```
      SN(I,J) = 0.0                                                   DAUX12
      DO 41 K=1,3                                                     DAUX12
   41 SN(I,J) = SN(I,J) + B12(I,K,2*M-1) * RPHI(K,N  ) * A22(K,J,2*N-2) DAUX12
      C(I,J,IJ  ) = -SN(I,J)                                          DAUX12
   42 C(J,I,IJ+1) = -SN(I,J)                                          DAUX12
      IJ = IJ+1                                                       DAUX12
   43 DO 49 L=N,NJNT                                                  DAUX12
      IF (L.EQ.M) GO TO 49                                            DAUX12
      IF (IABS(JNT(L)).NE.N ) GO TO 49                                DAUX12
      IF (FREE(L)) GO TO 49                                           SLIP
      MJNT = NQSJNT + L                                               DAUX12
      IJ = IJ+1                                                       DAUX12
      IJK(MQ,MJNT) = IJ                                               DAUX12
      IJK(MJNT,MQ) = IJ+1                                             DAUX12
      DO 48 I=1,3                                                     DAUX12
      DO 48 J=1,3                                                     DAUX12
      SN(I,J) = 0.0                                                   DAUX12
      DO 47 K=1,3                                                     DAUX12
   47 SN(I,J) = SN(I,J) + B12(I,K,2*M-1) * RPHI(K,N  ) * A22(K,J,2*L-1) DAUX12
      C(I,J,IJ  ) = SN(I,J)                                           DAUX12
   48 C(J,I,IJ+1) = SN(I,J)                                           DAUX12
      IJ = IJ +1                                                      DAUX12
   49 CONTINUE                                                        DAUX12
   50 IF  (M.EQ.NJNT)  GO TO 60                                       DAUX12
      IF  (ISING(M+1).NE.0)  GO TO 60                                 DAUX12
      M1 = M+1                                                        DAUX12
      DO 59 L=M1,NJNT                                                 DAUX12
      IF (IABS(JNT(L)).NE.M1) GO TO 59                                DAUX12
      IF (FREE(L)) GO TO 59                                           SLIP
      MJNT = NQSJNT + L                                               DAUX12
      IJ = IJ+1                                                       DAUX12
      IJK(MQ,MJNT) = IJ                                               DAUX12
      IJK(MJNT,MQ) = IJ+1                                             DAUX12
      DO 58 I=1,3                                                     DAUX12
      DO 58 J=1,3                                                     DAUX12
      SM(I,J) = 0.0                                                   DAUX12
      DO 57 K=1,3                                                     DAUX12
   57 SM(I,J) = SM(I,J) + B12(I,K,2*M  ) * RPHI(K,M+1) * A22(K,J,2*L-1) DAUX12
      C(I,J,IJ  ) = SM(I,J)                                           DAUX12
   58 C(J,I,IJ+1) = SM(I,J)                                           DAUX12
      IJ = IJ +1                                                      DAUX12
   59 CONTINUE                                                        DAUX12
   60 CONTINUE                                                        DAUX12
      CALL ELTIME(2,15)                                               DAUX12
      RETURN                                                          DAUX12
      END                                                             DAUX12
```

```
      SUBROUTINE DAUX22                                                 DAUX22
C                                                   REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE DAUX TO COMPUTE                              DAUX22
C                                                                       DAUX22
C                                                                       DAUX22
C                              -1                                       DAUX22
C         (C22) = (B22)(PHI)   (A22) - (B24)                            DAUX22
C                                                                       DAUX22
C                              -1                                       DAUX22
C         (R2)  = (B22)(PHI)   (U2)  - (V2)                             DAUX22
C                                                                       DAUX22
      IMPLICIT REAL*8(A-H,O-Z)                                          DAUX22
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DAUX22
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DAUX22
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DAUX22
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DAUX22
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DAUX22
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX22
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      LOGICAL*1 FREE,LDMMY                                              80386
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S            CHGIII
     *              ,DN(3,3),DM(3,3),SN(3,3),SM(3,3),HH(3,3),BN(3)      DAUX22
     *              ,IDUM(362),FREE(30),LDMMY(2),DMMY(27859)            80386
      LOGICAL TEST                                                      DAUX22
      CALL ELTIME(1,16)                                                 DAUX22
      NQSJNT = NQ2S + NJNT                                              DAUX22
      DO 90 M=1,NJNT                                                    DAUX22
      MJNT = NQSJNT + M                                                 DAUX22
      DO 60 I=1,3                                                       DAUX22
   60 RHS(I,MJNT) = V2(I,M)                                             DAUX22
      N = IABS(JNT(M))                                                  DAUX22
      IF (N.EQ.0) GO TO 90                                              DAUX22
      IF (FREE(M)) GO TO 90                                             SLIP
      IJ = IJ+1                                                         DAUX22
      IJK(MJNT,MJNT) = IJ                                               DAUX22
      DO 61 J=1,3                                                       DAUX22
      DO 61 I=1,3                                                       DAUX22
   61 HH(I,J) = 0.0                                                     DAUX22
      LGO = IPIN(M)+8                                                   SLIP
      TEST = .FALSE.                                                    DAUX22
      GO TO (64,64,64,62,64,64,64,64,63,64,64,64,64,63,63),LGO          SLIP
   62 IF (IEULER(M).GE.7) GO TO 64                                      DAUX22
      TEST = IEULER(M).LT.4                                             DAUX22
   63 AN = 0.0                                                          DAUX22
      DO 51 J=1,3                                                       DAUX22
   51 AN = AN + HB(J,2*M-1)**2 * RPHI(J N )                             DAUX22
     *        + HB(J,2*M  )**2 * RPHI(J,M+1)                            DAUX22
      IF (TEST) GO TO 64                                                DAUX22
```

```
      CALL DOT31 (D(1,1,N),HB(1,2*M-1),BN)                              DAUX22
      DO 53 J=1,3                                                       DAUX22
      DO 53 I=1,3                                                       DAUX22
   53 HH(I,J) = AN*BN(I)*BN(J)                                          DAUX22
   64 DO 67 I=1,3                                                       DAUX22
      RHS(I,MJNT) = -V2(I,M)                                            DAUX22
      DO 66 J=1,3                                                       DAUX22
      RHS(I,MJNT) = RHS(I,MJNT) + A22(J,I,2*M-1)*U2(J,N  )              DAUX22
     *                          - A22(J,I,2*M  )*U2(J,M+1)              DAUX22
      SN(I,J) = 0.0                                                     DAUX22
      IF (TEST) GO TO 66                                                DAUX22
      DO 65 K=1,3                                                       DAUX22
   65 SN(I,J) = SN(I,J) + A22(K,I,2*M-1) * RPHI(K,N  ) * A22(K,J,2*M-1) DAUX22
     *                  + A22(K,I,2*M  ) * RPHI(K,M+1) * A22(K,J,2*M  ) DAUX22
   66 C(I,J,IJ) = SN(I,J) + HH(I,J)                                     DAUX22
   67 IF (TEST) C(I,I,IJ) = AN                                          DAUX22
      IF  (ISING(N).NE.0)  GO TO 90                                     DAUX22
      IF (N.EQ.1) GO TO 80                                              DAUX22
      IF (FREE(N-1)) GO TO 80                                           SLIP
      N1JNT = NQSJNT + N -1                                             DAUX22
      IJ = IJ+1                                                         DAUX22
      IJK(MJNT,N1JNT) = IJ                                              DAUX22
      IJK(N1JNT,MJNT) = IJ+1                                            DAUX22
      DO 77 I=1,3                                                       DAUX22
      DO 77 J=1,3                                                       DAUX22
      SN(I,J) = 0.0                                                     DAUX22
      DO 76 K=1,3                                                       DAUX22
   76 SN(I,J) = SN(I,J) + A22(K,I,2*M-1) * RPHI(K,N  ) * A22(K,J,2*N-2) DAUX22
      C(I,J,IJ)    = -SN(I,J)                                           DAUX22
   77 C(J,I,IJ+1) = -SN(I,J)                                            DAUX22
      IJ = IJ+1                                                         DAUX22
   80 IF (M.EQ.NJNT) GO TO 90                                           DAUX22
      M1 = M+1                                                          DAUX22
      DO  88 L=M1,NJNT                                                  DAUX22
      IF (IABS(JNT(L)).NE.N) GO TO 88                                   DAUX22
      IF (FREE(L)) GO TO 88                                             SLIP
      LJNT = NQSJNT + L                                                 DAUX22
      IJ = IJ+1                                                         DAUX22
      IJK(MJNT,LJNT) = IJ                                               DAUX22
      IJK(LJNT,MJNT) = IJ+1                                             DAUX22
      DO 87 I=1,3                                                       DAUX22
      DO 87 J=1,3                                                       DAUX22
      SN(I,J) = 0.0                                                     DAUX22
      DO 86 K=1,3                                                       DAUX22
   86 SN(I,J) = SN(I,J) + A22(K,I,2*M-1) * RPHI(K,N  ) * A22(K,J,2*L-1) DAUX22
      C(I,J,IJ)    = SN(I,J)                                            DAUX22
   87 C(J,I,IJ+1) = SN(I,J)                                             DAUX22
      IJ = IJ+1                                                         DAUX22
   88 CONTINUE                                                          DAUX22
   90 CONTINUE                                                          DAUX22
      CALL ELTIME(2,16)                                                 DAUX22
      RETURN                                                            DAUX22
```

END

```
      SUBROUTINE DAUX31                                                  DAUX31
C                                                    REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE DAUX TO COMPUTE                               DAUX31
C                                                                        DAUX31
C                       -1                   -1                          DAUX31
C     (C13) = (B11)(M)   (A13) + (B12)(PHI)   (A23)                      DAUX31
C                                                                        DAUX31
C                       -1                   -1                          DAUX31
C     (C31) = (B31)(M)   (A11) + (B32)(PHI)   (A21)                      DAUX31
C                                                                        DAUX31
      IMPLICIT REAL*8 (A-H,O-Z)                                          DAUX31
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,            DAUX31
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60),  SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),      DAUX31
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)     DAUX31
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX31
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                 SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),    DAUX31
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),DAUX31
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),               DAUX31
     *               KQ1(12),KQ2(12),KQTYPE(12)                          DAUX31
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S,DMMY(28092)80386
      CALL ELTIME(1,17)                                                  DAUX31
      DO 30 N=1,NQ                                                       DAUX31
      IF (KQTYPE(N).LT.0) GO TO 30                                       DAUX31
      K1 = KQ1(N)                                                        DAUX31
      K2 = KQ2(N)                                                        DAUX31
      NNS = NQ2S - NQ + N                                                DAUX31
      IF (K1.LE.1) GO TO 13                                              DAUX31
      IF (IABS(JNT(K1-1)).EQ.0) GO TO 13                                 DAUX31
      IF  (ISING(K1).NE.0)  GO TO 13                                     DAUX31
C                                                                        DAUX31
C                                    -1                                  DAUX31
C     C13(K1-1,N) = B11(K1-1,K1)M      (K1)A13(K1,N)                     DAUX31
C                                      -1                                DAUX31
C                 + B12(K1-1,K1)PHI  (K1)A23(K1,N)                       DAUX31
C                                                                        DAUX31
C                               -1                                       DAUX31
C     C31(N,K1-1) = B31(N,K1)M      (K1)A11(K1,K1-1)                     DAUX31
C                                 -1                                     DAUX31
C                 + B32(N,K1)PHI  (K1)A21(K1,K1-1)                       DAUX31
C                                                                        DAUX31
      MQ = NQ2S + K1 - 1                                                 DAUX31
      IJ = IJ+1                                                          DAUX31
      IJK(MQ,NNS) = IJ                                                   DAUX31
      IJK(NNS,MQ) = IJ+1                                                 DAUX31
      DO 12 I=1,3                                                        DAUX31
      DO 12 J=1,3                                                        DAUX31
      SUM = 0.0                                                          SLIP
      TUM = 0.0                                                          SLIP
      DO 11 K=1,3                                                        DAUX31
```

```
      SUM = SUM + B12(I,K,2*K1-2)*RPHI(K,K1)*A23(K,J,2*N-1 )            DAUX31
     *            - A11(I,K,K1-1)*RW(K1)*A13(K,J,2*N-1)                 SLIP
   11 TUM = TUM + B32(I,K,2*N-1 )*RPHI(K,K1)*B12(J,K,2*K1-2)            DAUX31
     *            - B31(I,K,2*N-1)*RW(K1)*A11(K,J,K1-1)                 SLIP
      C(I,J,IJ)    = SUM                                                DAUX31
   12 C(I,J,IJ+1) = TUM                                                 DAUX31
      IJ = IJ+1                                                         DAUX31
   13 IF (K2.LE.1) GO TO 16                                             DAUX31
      IF (IABS(JNT(K2-1)).EQ.0) GO TO 16                                DAUX31
      IF  (ISING(K2).NE.0)  GO TO 16                                    DAUX31
C                                                                       DAUX31
C                                      -1                               DAUX31
C     C13(K2-1,N) = B11(K2-1,K2)M     (K2)A13(K2,N)                     DAUX31
C                                        -1                             DAUX31
C                 + B12(K2-1,K2)PHI   (K2)A23(K2,N)                     DAUX31
C                                                                       DAUX31
C                                  -1                                   DAUX31
C     C31(N,K2-1) = B31(N,K2)M     (K2)A11(K2,K2-1)                     DAUX31
C                                    -1                                 DAUX31
C                 + B32(N,K2)PHI   (K2)A21(K2,K2-1)                     DAUX31
C                                                                       DAUX31
      MQ = NQ2S + K2 - 1                                                DAUX31
      IJ = IJ+1                                                         DAUX31
      IJK(MQ,NNS) = IJ                                                  DAUX31
      IJK(NNS,MQ) = IJ+1                                                DAUX31
      DO 15 I=1,3                                                       DAUX31
      DO 15 J=1,3                                                       DAUX31
      SUM = 0.0                                                         SLIP
      TUM = 0.0                                                         SLIP
      DO 14 K=1,3                                                       DAUX31
      SUM = SUM + B12(I,K,2*K2-2)*RPHI(K,K2)*A23(K,J,2*N    )           DAUX31
     *            - A11(I,K,K2-1)*RW(K2)*A13(K,J,2*N)                   SLIP
   14 TUM = TUM + B32(I,K,2*N    )*RPHI(K,K2)*B12(J,K,2*K2-2)           DAUX31
     *            - B31(I,K,2*N)*RW(K2)*A11(K,J,K2-1)                   SLIP
      C(I,J,IJ)   = SUM                                                 DAUX31
   15 C(I,J,IJ+1) = TUM                                                 DAUX31
      IJ = IJ+1                                                         DAUX31
   16 IF (NJNT.LE.0) GO TO 30                                           DAUX31
      DO 26 L=1,NJNT                                                    DAUX31
      IF (IABS(JNT(L)).NE.K1) GO TO 21                                  DAUX31
      IF  (ISING(K1).NE.0)  GO TO 21                                    DAUX31
C                                                                       DAUX31
C     FOR ANY L SUCH THAT JNT(L) = K1                                   DAUX31
C                                                                       DAUX31
C                            -1                                         DAUX31
C     C13(L,N) = B11(L,K1)M     (K1)A13(K1,N)                           DAUX31
C                               -1                                      DAUX31
C              + B12(L,K1)PHI   (K1)A23(K1,N)                           DAUX31
C                                                                       DAUX31
C                            -1                                         DAUX31
C     C31(N,L) = B31(N,K1)M     (K1)A11(K1,L)                           DAUX31
C                               -1                                      DAUX31
```

```
C                + B32(N,K1)PHI   (K1)A21(K1,L)                          DAUX31
C                                                                        DAUX31
      MQ = NQ2S + L                                                      DAUX31
      IF (IJK(MQ,NNS).NE.0) GO TO 18                                     DAUX31
      IJ = IJ+1                                                          DAUX31
      IJK(MQ,NNS) = IJ                                                   DAUX31
      IJK(NNS,MQ) = IJ+1                                                 DAUX31
      DO 17 J=1,3                                                        DAUX31
      DO 17 I=1,3                                                        DAUX31
      C(I,J,IJ  ) = 0.0                                                  DAUX31
   17 C(I,J,IJ+1) = 0.0                                                  DAUX31
      IJ = IJ+1                                                          DAUX31
   18 JJ = IJK(MQ,NNS)                                                   DAUX31
      DO 20 I=1,3                                                        DAUX31
      DO 20 J=1,3                                                        DAUX31
      SUM = C(I,J,JJ)                                                    SLIP
      TUM = C(I,J,JJ+1)                                                  SLIP
      DO 19 K=1,3                                                        DAUX31
      SUM = SUM + B12(I,K,2*L-1)*RPHI(K,K1)*A23(K,J,2*N-1)               DAUX31
     *          +A11(I,K,L)*RW(K1)*A13(K,J,2*N-1)                        SLIP
   19 TUM = TUM + B32(I,K,2*N-1)*RPHI(K,K1)*B12(J,K,2*L-1)               DAUX31
     *          +B31(I,K,2*N-1)*RW(K1)*A11(J,K,L)                        SLIP
      C(I,J,JJ)   = SUM                                                  DAUX31
   20 C(I,J,JJ+1) = TUM                                                  DAUX31
   21 IF (IABS(JNT(L)).NE.K2) GO TO 26                                   DAUX31
      IF  (ISING(K2).NE.0)  GO TO 26                                     DAUX31
C                                                                        DAUX31
C     FOR ANY L SUCH THAT JNT(L) = K2                                    DAUX31
C                                                                        DAUX31
C                                 -1                                     DAUX31
C     C13(L,N) = B11(L,K2)M     (K2)A13(K2,N)                            DAUX31
C                                  -1                                    DAUX31
C              + B12(L,K2)PHI   (K2)A23(K2,N)                            DAUX31
C                                                                        DAUX31
C                                 -1                                     DAUX31
C     C31(N,L) = B31(N,K2)M     (K2)A11(K2,L)                            DAUX31
C                                  -1                                    DAUX31
C              + B32(N,K2)PHI   (K2)A21(K2,L)                            DAUX31
C                                                                        DAUX31
      MQ = NQ2S + L                                                      DAUX31
      IF (IJK(MQ,NNS).NE.0) GO TO 23                                     DAUX31
      IJ = IJ+1                                                          DAUX31
      IJK(MQ,NNS) = IJ                                                   DAUX31
      IJK(NNS,MQ) = IJ+1                                                 DAUX31
      DO 22 J=1,3                                                        DAUX31
      DO 22 I=1,3                                                        DAUX31
      C(I,J,IJ  ) = 0.0                                                  DAUX31
   22 C(I,J,IJ+1) = 0.0                                                  DAUX31
      IJ = IJ+1                                                          DAUX31
   23 JJ = IJK(MQ,NNS)                                                   DAUX31
      DO 25 I=1,3                                                        DAUX31
      DO 25 J=1,3                                                        DAUX31
```

```
      SUM = C(I,J,JJ)                                         SLIP
      TUM = C(I,J,JJ+1)                                       SLIP
      DO 24 K=1,3                                             DAUX31
      SUM = SUM + B12(I,K,2*L-1)*RPHI(K,K2)*A23(K,J,2*N  )    DAUX31
     *          + A11(I,K,L)*RW(K2)*A13(K,J,2*N)              SLIP
   24 TUM = TUM + B32(I,K,2*N  )*RPHI(K,K2)*B12(J,K,2*L-1)    DAUX31
     *          + B31(I,K,2*N)*RW(K2)*A11(J,K,L)              SLIP
      C(I,J,JJ)   = SUM                                       DAUX31
   25 C(I,J,JJ+1) = TUM                                       DAUX31
   26 CONTINUE                                                DAUX31
   30 CONTINUE                                                DAUX31
      CALL ELTIME(2,17)                                       DAUX31
      RETURN                                                  DAUX31
      END                                                     DAUX31
```

```
      SUBROUTINE DAUX32                                                  DAUX32
C                                                   REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE DAUX TO COMPUTE                               DAUX32
C                                                                        DAUX32
C                            -1                                          DAUX32
C     (C23) = (B22)(PHI)  (A23)                                          DAUX32
C                                                                        DAUX32
C                            -1                                          DAUX32
C     (C32) = (B32)(PHI)  (A22)                                          DAUX32
C                                                                        DAUX32
      IMPLICIT REAL*8 (A-H,O-Z)                                          DAUX32
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL.NBLT,NBAG,NVEH,NGRND,            DAUX32
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60),  SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),      DAUX32
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)     DAUX32
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX32
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                 SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),    DAUX32
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),DAUX32
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),               DAUX32
     *               KQ1(12),KQ2(12),KQTYPE(12)                          DAUX32
      LOGICAL*1 FREE,LDMMY                                               80386
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S             CHGIII
     *             ,DN(3,3),DM(3,3),BN(3),IDUM(416),FREE(30)             SLIP
     *            ,LDMMY(2),DMMY(27859)                                  80386
      CALL ELTIME(1,18)                                                  DAUX32
      NQSJNT = NQ2S + NJNT                                               DAUX32
      DO 60 N=1,NQ                                                       DAUX32
      IF (KQTYPE(N).LT.0) GO TO 60                                       DAUX32
      K1 = KQ1(N)                                                        DAUX32
      K2 = KQ2(N)                                                        DAUX32
      NNS = NQ2S - NQ + N                                                DAUX32
      IF (K1.LE.1)        GO TO 43                                       DAUX32
      IF (IABS(JNT(K1-1)).EQ.0) GO TO 43                                 DAUX32
      IF (FREE(K1-1)) GO TO 43                                           SLIP
      IF  (ISING(K1).NE.0)  GO TO 43                                     DAUX32
C                                                                        DAUX32
C                                        -1                              DAUX32
C     C23(K1-1,N) = B22(K1-1,K1)PHI   (K1)A23(K1,N)                      DAUX32
C                                                                        DAUX32
C                                     -1                                 DAUX32
C     C32(N,K1-1) = B32(N,K1)PHI   (K1)A22(K1,K1-1)                      DAUX32
C                                                                        DAUX32
      KJNT = NQSJNT + K1 - 1                                             DAUX32
      IJ = IJ+1                                                          DAUX32
      IJK(KJNT,NNS) = IJ                                                 DAUX32
      IJK(NNS,KJNT) = IJ+1                                               DAUX32
      DO 42 I=1,3                                                        DAUX32
      DO 42 J=1,3                                                        DAUX32
      SUM = 0.0                                                          DAUX32
      TUM = 0.0                                                          DAUX32
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```
      DO 41 K=1,3                                                       DAUX32
      SUM = SUM + A22(K,I,2*K1-2) * RPHI(K,K1) * A23(K,J,2*N-1 )        DAUX32
   41 TUM = TUM + B32(I,K,2*N-1 ) * RPHI(K,K1) * A22(K,J,2*K1-2)        DAUX32
      C(I,J,IJ  ) = -SUM                                                DAUX32
   42 C(I,J,IJ+1) = -TUM                                                DAUX32
      IJ = IJ+1                                                         DAUX32
   43 IF (K2.LE.1)        GO TO 46                                      DAUX32
      IF (IABS(JNT(K2-1)).EQ.0) GO TO 46                                DAUX32
      IF (FREE(K2-1)) GO TO 46                                          SLIP
      IF  (ISING(K2).NE.0)  GO TO 46                                    DAUX32
C                                                                       DAUX32
C                                        -1                             DAUX32
C     C23(K2-1,N) = B22(K2-1,K2)PHI   (K2)A23(K2,N)                     DAUX32
C                                                                       DAUX32
C                                   -1                                  DAUX32
C     C32(N,K2-1) = B32(N,K2)PHI   (K2)A22(K2,K2-1)                     DAUX32
C                                                                       DAUX32
      KJNT = NQSJNT + K2 - 1                                            DAUX32
      IJ = IJ+1                                                         DAUX32
      IJK(KJNT,NNS) = IJ                                                DAUX32
      IJK(NNS,KJNT) = IJ+1                                              DAUX32
      DO 45 I=1,3                                                       DAUX32
      DO 45 J=1,3                                                       DAUX32
      SUM = 0.0                                                         DAUX32
      TUM = 0.0                                                         DAUX32
      DO 44 K=1,3                                                       DAUX32
      SUM = SUM + A22(K,I,2*K2-2) * RPHI(K,K2) * A23(K,J,2*N   )        DAUX32
   44 TUM = TUM + B32(I,K,2*N   ) * RPHI(K,K2) * A22(K,J,2*K2-2)        DAUX32
      C(I,J,IJ  ) = -SUM                                                DAUX32
   45 C(I,J,IJ+1) = -TUM                                                DAUX32
      IJ = IJ+1                                                         DAUX32
   46 IF (NJNT.LE.0)      GO TO 60                                      DAUX32
      DO 56 L=1,NJNT                                                    DAUX32
      IF (FREE(L)) GO TO 56                                             SLIP
      IF (IABS(JNT(L)).NE.K1) GO TO 51                                  DAUX32
      IF  (ISING(K1).NE.0)  GO TO 51                                    DAUX32
C                                                                       DAUX32
C     FOR ANY L SUCH THAT JNT(L) = K1                                   DAUX32
C                                                                       DAUX32
C                                  -1                                   DAUX32
C     C23(L,N) = B22(L,K1)PHI   (K1)A23(K1,N)                           DAUX32
C                                                                       DAUX32
C                                  -1                                   DAUX32
C     C32(N,L) = B32(N,K1)PHI   (K1)A22(K1,L)                           DAUX32
C                                                                       DAUX32
      KJNT = NQSJNT + L                                                 DAUX32
      IF (IJK(KJNT,NNS).NE.0) GO TO 48                                  DAUX32
      IJ = IJ+1                                                         DAUX32
      IJK(KJNT,NNS) = IJ                                                DAUX32
      IJK(NNS,KJNT) = IJ+1                                              DAUX32
      DO 47 J=1,3                                                       DAUX32
      DO 47 I=1,3                                                       DAUX32
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      C(I,J,IJ  ) = 0.0                                              DAUX32
   47 C(I,J,IJ+1) = 0.0                                              DAUX32
      IJ = IJ+1                                                      DAUX32
   48 JJ = IJK(KJNT,NNS)                                             DAUX32
      DO 50 I=1,3                                                    DAUX32
      DO 50 J=1,3                                                    DAUX32
      SUM = C(I,J,JJ)                                                DAUX32
      TUM = C(I,J,JJ+1)                                              DAUX32
      DO 49 K=1,3                                                    DAUX32
      SUM = SUM + A22(K,I,2*L-1 ) * RPHI(K,K1) * A23(K,J,2*N-1 )     DAUX32
   49 TUM = TUM + B32(I,K,2*N-1 ) * RPHI(K,K1) * A22(K,J,2*L-1 )     DAUX32
      C(I,J,JJ)   = SUM                                              DAUX32
   50 C(I,J,JJ+1) = TUM                                              DAUX32
   51 IF (IABS(JNT(L)).NE.K2) GO TO 56                               DAUX32
      IF  (ISING(K2).NE.0)  GO TO 56                                 DAUX32
C                                                                    DAUX32
C     FOR ANY L SUCH THAT JNT(L) = K2                                DAUX32
C                                                                    DAUX32
C                                   -1                               DAUX32
C     C23(L,N) = B22(L,K2)PHI  (K2)A23(K2,N)                         DAUX32
C                                                                    DAUX32
C                                   -1                               DAUX32
C     C32(N,L) = B32(N,K2)PHI  (K2)A22(K2,L)                         DAUX32
C                                                                    DAUX32
      KJNT = NQSJNT + L                                              DAUX32
      IF (IJK(KJNT,NNS).NE.0) GO TO 53                               DAUX32
      IJ = IJ+1                                                      DAUX32
      IJK(KJNT,NNS) = IJ                                             DAUX32
      IJK(NNS,KJNT) = IJ+1                                           DAUX32
      DO 52 J=1,3                                                    DAUX32
      DO 52 I=1,3                                                    DAUX32
      C(I,J,IJ  ) = 0.0                                              DAUX32
   52 C(I,J,IJ+1) = 0.0                                              DAUX32
      IJ = IJ+1                                                      DAUX32
   53 JJ = IJK(KJNT,NNS)                                             DAUX32
      DO 55 I=1,3                                                    DAUX32
      DO 55 J=1,3                                                    DAUX32
      SUM = C(I,J,JJ)                                                DAUX32
      TUM = C(I,J,JJ+1)                                              DAUX32
      DO 54 K=1,3                                                    DAUX32
      SUM = SUM + A22(K,I,2*L-1 ) * RPHI(K,K2) * A23(K,J,2*N   )     DAUX32
   54 TUM = TUM + B32(I,K,2*N   ) * RPHI(K,K2) * A22(K,J,2*L-1 )     DAUX32
      C(I,J,JJ)   = SUM                                              DAUX32
   55 C(I,J,JJ+1) = TUM                                              DAUX32
   56 CONTINUE                                                       DAUX32
   60 CONTINUE                                                       DAUX32
      CALL ELTIME(2,18)                                              DAUX32
      RETURN                                                         DAUX32
      END                                                            DAUX32
```

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      SUBROUTINE DAUX33                                                 DAUX33
C                                                  REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE DAUX TO COMPUTE                              DAUX33
C                                                                       DAUX33
C                      -1                  -1                           DAUX33
C     (C33) = (B31)(M)   (A13) + (B32)(PHI)   (A23) - (B35)             DAUX33
C                                                                       DAUX33
C                      -1                  -1                           DAUX33
C     (R3)  = (B31)(M)   (U1)  + (B32)(PHI)   (U2)  - (V3)              DAUX33
C                                                                       DAUX33
      IMPLICIT REAL*8 (A-H,O-Z)                                         DAUX33
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DAUX33
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DAUX33
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DAUX33
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DAUX33
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DAUX33
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX33
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   DAUX33
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),DAUX33
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              DAUX33
     *               KQ1(12),KQ2(12),KQTYPE(12)                         DAUX33
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S,DMMY(28092)80386
      CALL ELTIME(1,19)                                                 DAUX33
      DO 90 N=1,NQ                                                      DAUX33
      IF (KQTYPE(N).LT.0) GO TO 90                                      DAUX33
      K1 = KQ1(N)                                                       DAUX33
      K2 = KQ2(N)                                                       DAUX33
      NNS = NQ2S - NQ + N                                               DAUX33
C                                                                       DAUX33
C                        -1                          -1                 DAUX33
C     RHS(N) = B31(N,K1)M  (K1)U1(K1) + B32(N,K1)PHI   (K1)U2(K1)       DAUX33
C                        -1                          -1                 DAUX33
C            + B31(N,K2)M  (K2)U1(K2) + B32(N,K2)PHI   (K2)U2(K2)       DAUX33
C                                                                       DAUX33
C            - V3(N)                                                    DAUX33
C                                                                       DAUX33
      DO 63 I=1,3                                                       DAUX33
      SUM = 0.0                                                         DAUX33
      DO 62 K=1,3                                                       DAUX33
   62 SUM = SUM + B31(I,K,2*N-1)*U1(K,K1) + B32(I,K,2*N-1)*U2(K,K1)     DAUX33
     *          + B31(I,K,2*N  )*U1(K,K2) + B32(I,K,2*N  )*U2(K,K2)     DAUX33
   63 RHS(I,NNS) = SUM - V3(I,N)                                        DAUX33
C                                                                       DAUX33
C                          -1                          -1               DAUX33
C     C33(N,N) = B31(N,K1)M  (K1)A13(K1,N) + B32(N,K1)PHI  (K1)A23(K1,N)DAUX33
C                          -1                          -1               DAUX33
C              + B31(N,K2)M  (K2)A13(K2,N) + B32(N,K2)PHI  (K2)A23(K2,N)DAUX33
C                                                                       DAUX33
C              - B35(N,N)                                               DAUX33
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C                                                                       DAUX33
      IJ = IJ+1                                                         DAUX33
      IJK(NNS,NNS) = IJ                                                 DAUX33
      IF (KQTYPE(N).EQ.2) GO TO 51                                      DAUX33
      IF (KQTYPE(N).EQ.4) GO TO 51                                      DAUX33
      DO 65 I=1,3                                                       DAUX33
      DO 65 J=1,3                                                       DAUX33
      SUM = -HHT(I,J,N)                                                 DAUX33
      IF (I.EQ.J) SUM = 1.0+SUM                                         DAUX33
      DO 64 K=1,3                                                       DAUX33
   64 SUM = SUM + B31(I,K,2*N-1)*  RW(  K1)*A13(K,J,2*N-1)              DAUX33
     *            + B31(I,K,2*N  )*  RW(  K2)*A13(K,J,2*N  )            DAUX33
     *            + B32(I,K,2*N-1)*RPHI(K,K1)*A23(K,J,2*N-1)            DAUX33
     *            + B32(I,K,2*N  )*RPHI(K,K2)*A23(K,J,2*N  )            DAUX33
   65 C(I,J,IJ) = SUM                                                   DAUX33
      GO TO 59                                                          DAUX33
C                                                                       DAUX33
C     FOR KQTYPE = 2 OR 4. SET C33(N,N) = B*I                           DAUX33
C     WHERE B = SUM OF DIAGONAL ELEMENTS OF                             DAUX33
C             -1                    -1                                  DAUX33
C     (B31)(M)  (A13) + (B32)(PHI)  (A23)                               DAUX33
C                                                                       DAUX33
   51 SUM = 0.0                                                         DAUX33
      DO 55 I=1,3                                                       DAUX33
      DO 55 K=1,3                                                       DAUX33
   55 SUM = SUM + B31(I,K,2*N-1)*  RW(  K1)*A13(K,I,2*N-1)              DAUX33
     *            + B31(I,K,2*N  )*  RW(  K2)*A13(K,I,2*N  )            DAUX33
     *            + B32(I,K,2*N-1)*RPHI(K,K1)*A23(K,I,2*N-1)            DAUX33
     *            + B32(I,K,2*N  )*RPHI(K,K2)*A23(K,I,2*N  )            DAUX33
      DO 57 I=1,3                                                       DAUX33
      DO 56 J=1,3                                                       DAUX33
   56 C(I,J,IJ) = 0.0                                                   DAUX33
   57 C(I,I,IJ) = SUM                                                   DAUX33
   59 IF (N.EQ.NQ) GO TO 90                                             DAUX33
      N1 = N+1                                                          DAUX33
      DO 85 M=N1,NQ                                                     DAUX33
      IF (KQTYPE(M).LT.0) GO TO 85                                      DAUX33
      MNS = NQ2S - NQ + M                                               DAUX33
      IF  (ISING(K1).NE.0)  GO TO 75                                    DAUX33
      IF (K1.NE.KQ1(M))         GO TO 70                                DAUX33
      IF (IJK(MNS,NNS).NE.0) GO TO 67                                   DAUX33
C                                                                       DAUX33
C     FOR ANY M>N SUCH THAT K1(N) = K1(M)                               DAUX33
C                                                                       DAUX33
C                                             -1                        DAUX33
C     C33(N,M) = C(N,M) + B31(N,K1)  M  (K1)A13(K1,M)                   DAUX33
C                                             -1                        DAUX33
C                         + B32(N,K1)PHI  (K1)A23(K1,M)                 DAUX33
C                                                                       DAUX33
C                                             -1                        DAUX33
C     C33(M,N) = C(M,N) + B31(M,K1)  M  (K1)A13(K1,N)                   DAUX33
C                                             -1                        DAUX33
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C                          + B32(M,K1)PHI   (K1)A23(K1,N)                DAUX33
C                                                                        DAUX33
      IJ = IJ+1                                                          DAUX33
      IJK(MNS,NNS) = IJ                                                  DAUX33
      IJK(NNS,MNS) = IJ+1                                                DAUX33
      DO 66 J=1,3                                                        DAUX33
      DO 66 I=1,3                                                        DAUX33
      C(I,J,IJ  ) = 0.0                                                  DAUX33
   66 C(I,J,IJ+1) = 0.0                                                  DAUX33
      IJ = IJ+1                                                          DAUX33
   67 JJ = IJK(MNS,NNS)                                                  DAUX33
      DO 69 I=1,3                                                        DAUX33
      DO 69 J=1,3                                                        DAUX33
      SUM = C(I,J,JJ)                                                    DAUX33
      TUM = C(I,J,JJ+1)                                                  DAUX33
      DO 68 K=1,3                                                        DAUX33
      SUM = SUM + B31(I,K,2*N-1)*  RW(  K1)*A13(K,J,2*M-1)               DAUX33
     *          + B32(I,K,2*N-1)*RPHI(K,K1)*A23(K,J,2*M-1)               DAUX33
   68 TUM = TUM + B31(I,K,2*M-1)*  RW(  K1)*A13(K,J,2*N-1)               DAUX33
     *          + B32(I,K,2*M-1)*RPHI(K,K1)*A23(K,J,2*N-1)               DAUX33
      C(I,J,JJ  ) = SUM                                                  DAUX33
   69 C(I,J,JJ+1) = TUM                                                  DAUX33
   70 IF (K1.NE.KQ2(M))        GO TO 75                                  DAUX33
      IF (IJK(MNS,NNS).NE.0) GO TO 72                                    DAUX33
C                                                                        DAUX33
C     FOR ANY M>N SUCH THAT K1(N) = K2(M)                                DAUX33
C                                                                        DAUX33
C                                         -1                             DAUX33
C     C33(N,M) = C(N,M) + B31(N,K1)  M   (K1)A13(K2,M)                   DAUX33
C                                         -1                             DAUX33
C                          + B32(N,K1)PHI   (K1)A23(K2,M)                DAUX33
C                                                                        DAUX33
C                                         -1                             DAUX33
C     C33(M,N) = C(M,N) + B31(M,K2)  M   (K1)A13(K1,N)                   DAUX33
C                                         -1                             DAUX33
C                          + B32(M,K2)PHI   (K1)A23(K1,N)                DAUX33
C                                                                        DAUX33
      IJ = IJ+1                                                          DAUX33
      IJK(MNS,NNS) = IJ                                                  DAUX33
      IJK(NNS,MNS) = IJ+1                                                DAUX33
      DO 71 J=1,3                                                        DAUX33
      DO 71 I=1,3                                                        DAUX33
      C(I,J,IJ  ) = 0.0                                                  DAUX33
   71 C(I,J,IJ+1) = 0.0                                                  DAUX33
      IJ = IJ+1                                                          DAUX33
   72 JJ = IJK(MNS,NNS)                                                  DAUX33
      DO 74 I=1,3                                                        DAUX33
      DO 74 J=1,3                                                        DAUX33
      SUM = C(I,J,JJ)                                                    DAUX33
      TUM = C(I,J,JJ+1)                                                  DAUX33
      DO 73 K=1,3                                                        DAUX33
      SUM = SUM + B31(I,K,2*N-1)*  RW(  K1)*A13(K,J,2*M  )               DAUX33
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     *          + B32(I,K,2*N-1)*RPHI(K,K1)*A23(K,J,2*M  )                     DAUX33
   73 TUM = TUM + B31(I,K,2*M  )*  RW(  K1)*A13(K,J,2*N-1)                     DAUX33
     *          + B32(I,K,2*M  )*RPHI(K,K1)*A23(K,J,2*N-1)                     DAUX33
      C(I,J,JJ  ) = SUM                                                        DAUX33
   74 C(I,J,JJ+1) = TUM                                                        DAUX33
   75 IF  (ISING(K2).NE.0)  GO TO 85                                           DAUX33
      IF (K2.NE.KQ1(M))        GO TO 80                                        DAUX33
      IF (IJK(MNS,NNS).NE.0) GO TO 77                                          DAUX33
C                                                                              DAUX33
C     FOR ANY M>N SUCH THAT K2(N) = K1(M)                                      DAUX33
C                                                                              DAUX33
C                                     -1                                       DAUX33
C     C33(N,M) = C(N,M) + B31(N,K2)  M   (K2)A13(K1,M)                         DAUX33
C                                     -1                                       DAUX33
C                         + B32(N,K2)PHI   (K2)A23(K1,M)                       DAUX33
C                                                                              DAUX33
C                                     -1                                       DAUX33
C     C33(M,N) = C(M,N) + B31(M,K1)  M   (K2)A13(K2,N)                         DAUX33
C                                     -1                                       DAUX33
C                         + B32(M,K1)PHI   (K2)A23(K2,N)                       DAUX33
C                                                                              DAUX33
      IJ = IJ+1                                                                DAUX33
      IJK(MNS,NNS) = IJ                                                        DAUX33
      IJK(NNS,MNS) = IJ+1                                                      DAUX33
      DO 76 J=1,3                                                              DAUX33
      DO 76 I=1,3                                                              DAUX33
      C(I,J,IJ  ) = 0.0                                                        DAUX33
   76 C(I,J,IJ+1) = 0.0                                                        DAUX33
      IJ = IJ+1                                                                DAUX33
   77 JJ = IJK(MNS,NNS)                                                        DAUX33
      DO 79 I=1,3                                                              DAUX33
      DO 79 J=1,3                                                              DAUX33
      SUM = C(I,J,JJ)                                                          DAUX33
      TUM = C(I,J,JJ+1)                                                        DAUX33
      DO 78 K=1,3                                                              DAUX33
      SUM = SUM + B31(I,K,2*N  )*  RW(  K2)*A13(K,J,2*M-1)                     DAUX33
     *          + B32(I,K,2*N  )*RPHI(K,K2)*A23(K,J,2*M-1)                     DAUX33
   78 TUM = TUM + [illegible],2*M-1)*  RW(  K2)*A13(K,J,2*N  )                 DAUX33
     *          + [illegible]K,2*M-1)*RPHI(K,K2)*A23(K,J,2*N  )                DAUX33
      C(I,J,JJ  ) [illegible]                                                  DAUX33
   79 C(I,J,JJ+1) = TUM                                                        DAUX33
   80 IF (K2.NE.KQ2(M))      GO TO 85                                          DAUX33
      IF (IJK(MNS,NNS).NE.0) GO TO 82                                          DAUX33
C                                                                              DAUX33
C     FOR ANY M>N SUCH THAT K2(N) = K2(M)                                      DAUX33
C                                                                              DAUX33
C                                     -1                                       DAUX33
C     C33(N,M) = C(N,M) + B31(N,K2)  M   (K2)A13(K2,M)                         DAUX33
C                                     -1                                       DAUX33
C                         + B32(N,K2)PHI   (K2)A23(K2,M)                       DAUX33
C                                                                              DAUX33
C                                     -1                                       DAUX33
```

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C     C33(M,N) = C(M,N) + B31(M,K2)  M   (K2)A13(K2,N)                   DAUX33
C                                         -1                             DAUX33
C                           + B32(M,K2)PHI   (K2)A23(K2,N)               DAUX33
C                                                                        DAUX33
      IJ = IJ+1                                                          DAUX33
      IJK(MNS,NNS) = IJ                                                  DAUX33
      IJK(NNS,MNS) = IJ+1                                                DAUX33
      DO 81 J=1,3                                                        DAUX33
      DO 81 I=1,3                                                        DAUX33
      C(I,J,IJ  ) = 0.0                                                  DAUX33
   81 C(I,J,IJ+1) = 0.0                                                  DAUX33
      IJ = IJ+1                                                          DAUX33
   82 JJ = IJK(MNS,NNS)                                                  DAUX33
      DO 84 I=1,3                                                        DAUX33
      DO 84 J=1,3                                                        DAUX33
      SUM = C(I,J,JJ)                                                    DAUX33
      TUM = C(I,J,JJ+1)                                                  DAUX33
      DO 83 K=1,3                                                        DAUX33
      SUM = SUM + B31(I,K,2*N   )*  RW(   K2)*A13(K,J,2*M   )            DAUX33
     *          + B32(I,K,2*N   )*RPHI(K,K2)*A23(K,J,2*M   )             DAUX33
   83 TUM = TUM + B31(I,K,2*M   )*  RW(   K2)*A13(K,J,2*N   )            DAUX33
     *          + B32(I,K,2*M   )*RPHI(K,K2)*A23(K,J,2*N   )             DAUX33
      C(I,J,JJ  ) = SUM                                                  DAUX33
   84 C(I,J,JJ+1) = TUM                                                  DAUX33
   85 CONTINUE                                                           DAUX33
   90 CONTINUE                                                           DAUX33
      CALL ELTIME(2,19)                                                  DAUX33
      RETURN                                                             DAUX33
      END                                                                DAUX33
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      SUBROUTINE DAUX44                                                 DAUX44
C                                                    REV IV    07/24/86SLIP
      IMPLICIT REAL*8(A-H,O-Z)                                          DAUX44
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DAUX44
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DAUX44
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DAUX44
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DAUX44
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DAUX44
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX44
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   DAUX44
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),DAUX44
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              DAUX44
     *               KQ1(12),KQ2(12),KQTYPE(12)                         DAUX44
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          DAUX44
      LOGICAL*1 FREE,LDMMY                                              80386
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S            CHGIII
     *              ,IDUM(458),FREE(30),LDMMY(2),DMMY(27859)            80386
      IF (NFLX.EQ.0) GO TO 99                                           DAUX44
      CALL ELTIME(1,33)                                                 DAUX44
      DO 90 L=1,NFLX                                                    DAUX44
      N1 = NFLEX(1,L)                                                   DAUX44
      N2 = NFLEX(2,L)                                                   DAUX44
      N3 = NFLEX(3,L)                                                   DAUX44
      IJ = IJ+1                                                         DAUX44
      DO 10 I=1,3                                                       DAUX44
      DO 10 J=1,3                                                       DAUX44
      C(I,J,IJ) = 0.0                                                   DAUX44
      DO 10 K=1,3                                                       DAUX44
   10 C(I,J,IJ) = C(I,J,IJ) + B42(I,K,3*L-2)*RPHI(K,N1)*B42(J,K,3*L-2)  DAUX44
     *                      + B42(I,K,3*L-1)*RPHI(K,N2)*B42(J,K,3*L-1)  DAUX44
     *                      + B42(I,K,3*L  )*RPHI(K,N3)*B42(J,K,3*L  )  DAUX44
      NSL = 2*NS+L                                                      DAUX44
      IJK(NSL,NSL) = IJ                                                 DAUX44
      DO 20 I=1,3                                                       DAUX44
      RHS(I,NSL) = -V4(I,L)                                             DAUX44
      DO 20 J=1,3                                                       DAUX44
   20 RHS(I,NSL) = RHS(I,NSL) + B42(I,J,3*L-2)*U2(I,N1)                 DAUX44
     *                        + B42(I,J,3*L-1)*U2(I,N2)                 DAUX44
     *                        + B42(I,J,3*L  )*U2(I,N3)                 DAUX44
      IF (L.EQ.NFLX) GO TO 30                                           DAUX44
      LP1 = L+1                                                         DAUX44
      DO 29 M=LP1,NFLX                                                  DAUX44
      DO 28 II=1,3,2                                                    DAUX44
      IL = NFLEX(II,L)                                                  DAUX44
      IF  (ISING(IL).NE.0)  GO TO 28                                    DAUX44
      DO 27 JJ=1,3,2                                                    DAUX44
      IF (NFLEX(II,L).NE.NFLEX(JJ,M)) GO TO 27                          DAUX44
      NSM = 2*NS+M                                                      DAUX44
      JK = IJK(NSL,NSM)                                                 DAUX44
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      KJ = IJK(NSM,NSL)                                                 DAUX44
      IF (JK.GT.0) GO TO 22                                             DAUX44
      IJK(NSL,NSM) = IJ+1                                               DAUX44
      IJK(NSM,NSL) = IJ+2                                               DAUX44
      JK = IJ+1                                                         DAUX44
      KJ = IJ+2                                                         DAUX44
      IJ = IJ+2                                                         DAUX44
      DO 21 I=1,3                                                       DAUX44
      DO 21 J=1,3                                                       DAUX44
   21 C(I,J,JK) = 0.0                                                   DAUX44
   22 LI = 3*L+II-3                                                     DAUX44
      MJ = 3*M+JJ-3                                                     DAUX44
      DO 24 I=1,3                                                       DAUX44
      DO 24 J=1,3                                                       DAUX44
      DO 23 K=1,3                                                       DAUX44
   23 C(I,J,JK) = C(I,J,JK) + B42(I,K,LI)*RPHI(K,IL)*B42(J,K,MJ)        DAUX44
   24 C(J,I,KJ) = C(I,J,JK)                                             DAUX44
   27 CONTINUE                                                          DAUX44
   28 CONTINUE                                                          DAUX44
   29 CONTINUE                                                          DAUX44
   30 IF (NQ.EQ.0) GO TO 40                                             DAUX44
      DO 39 M=1,NQ                                                      DAUX44
      IF (KQTYPE(M).LT.0) GO TO 39                                      DAUX44
      DO 38 II=1,3                                                      DAUX44
      LM = 0                                                            DAUX44
      IF (NFLEX(II,L).EQ.KQ1(M)) LM = 2*M-1                             DAUX44
      IF (NFLEX(II,L).EQ.KQ2(M)) LM = 2*M                               DAUX44
      IF (LM.EQ.0) GO TO 38                                             DAUX44
      IL = NFLEX(II,L)                                                  DAUX44
      IF  (ISING(IL).NE.0)  GO TO 38                                    DAUX44
      NSM = 2*NS+NFLX+M                                                 DAUX44
      JK = IJK(NSL,NSM)                                                 DAUX44
      KJ = IJK(NSM,NSL)                                                 DAUX44
      IF (JK.GT.0) GO TO 32                                             DAUX44
      IJK(NSL,NSM) = IJ+1                                               DAUX44
      IJK(NSM,NSL) = IJ+2                                               DAUX44
      JK = IJ+1                                                         DAUX44
      KJ = IJ+2                                                         DAUX44
      IJ = IJ+2                                                         DAUX44
      DO 31 I=1,3                                                       DAUX44
      DO 31 J=1,3                                                       DAUX44
      C(I,J,JK) = 0.0                                                   DAUX44
   31 C(I,J,KJ) = 0.0                                                   DAUX44
   32 LI = 3*L+II-3                                                     DAUX44
      DO 33 I=1,3                                                       DAUX44
      DO 33 J=1,3                                                       DAUX44
      DO 33 K=1,3                                                       DAUX44
      C(I,J,JK) = C(I,J,JK) + B42(I,K,LI)*RPHI(K,IL)*A23(K,J,LM)        DAUX44
   33 C(I,J,KJ) = C(I,J,KJ) + B32(I,K,LM)*RPHI(K,IL)*B42(J,K,LI)        DAUX44
   38 CONTINUE                                                          DAUX44
   39 CONTINUE                                                          DAUX44
   40 IF (NJNT.EQ.0) GO TO 90                                           DAUX44
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      DO 59 M=1,NJNT                                                    DAUX44
      IF (JNT(M).EQ.0) GO TO 59                                         DAUX44
      DO 58 II=1,3                                                      DAUX44
      LM = 0                                                            DAUX44
      IF (NFLEX(II,L).EQ.IABS(JNT(M))) LM = 2*M-1                       DAUX44
      IF (NFLEX(II,L).EQ.M+1)          LM = 2*M                         DAUX44
      IF (LM.EQ.0) GO TO 58                                             DAUX44
      IL = NFLEX(II,L)                                                  DAUX44
      IF  (ISING(IL).NE.0)  GO TO 58                                    DAUX44
      NSM = 2*NS+NFLX+NQ+M                                              DAUX44
      JK = IJK(NSL,NSM)                                                 DAUX44
      KJ = IJK(NSM,NSL)                                                 DAUX44
      IF (JK.GT.0) GO TO 42                                             DAUX44
      IJK(NSL,NSM) = IJ+1                                               DAUX44
      IJK(NSM,NSL) = IJ+2                                               DAUX44
      JK = IJ+1                                                         DAUX44
      KJ = IJ+2                                                         DAUX44
      IJ = IJ+2                                                         DAUX44
      DO 41 I=1,3                                                       DAUX44
      DO 41 J=1,3                                                       DAUX44
   41 C(I,J,JK) = 0.0                                                   DAUX44
   42 LI = 3*L+II-3                                                     DAUX44
      DO 44 I=1,3                                                       DAUX44
      DO 44 J=1,3                                                       DAUX44
      DO 43 K=1,3                                                       DAUX44
   43 C(I,J,JK) = C(I,J,JK) + B42(I,K,LI)*RPHI(K,IL)*B12(J,K,LM)        DAUX44
   44 C(J,I,KJ) = C(I,J,JK)                                             DAUX44
      IF (FREE(M)) GO TO 58                                             SLIP
      NSM = 2*NS+NFLX+NQ+NJNT+M                                         DAUX44
      JK = IJK(NSL,NSM)                                                 DAUX44
      KJ = IJK(NSM,NSL)                                                 DAUX44
      IF (JK.GT.0) GO TO 52                                             DAUX44
      IJK(NSL,NSM) = IJ+1                                               DAUX44
      IJK(NSM,NSL) = IJ+2                                               DAUX44
      JK = IJ+1                                                         DAUX44
      KJ = IJ+2                                                         DAUX44
      IJ = IJ+2                                                         DAUX44
      DO 51 I=1,3                                                       DAUX44
      DO 51 J=1,3                                                       DAUX44
   51 C(I,J,JK) = 0.0                                                   DAUX44
   52 SET = 1.0                                                         DAUX44
      IF (IL.EQ.M+1) SET = -1.0                                         DAUX44
      DO 54 I=1,3                                                       DAUX44
      DO 54 J=1,3                                                       DAUX44
      DO 53 K=1,3                                                       DAUX44
   53 C(I,J,JK) = C(I,J,JK) + SET*B42(I,K,LI)*RPHI(K,IL)*A22(K,J,LM)    DAUX44
   54 C(J,I,KJ) = C(I,J,JK)                                             DAUX44
   58 CONTINUE                                                          DAUX44
   59 CONTINUE                                                          DAUX44
   90 CONTINUE                                                          DAUX44
      CALL ELTIME(2,33)                                                 DAUX44
   99 RETURN                                                            DAUX44
```

END

DAUX44

```
      SUBROUTINE DAUX55                                                 DAUX55
C                                                  REV IV    07/24/86SLIP
      IMPLICIT REAL*8(A-H,O-Z)                                          DAUX55
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DAUX55
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DAUX55
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DAUX55
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DAUX55
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DAUX55
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),DAUX55
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   DAUX55
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),DAUX55
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              DAUX55
     *               KQ1(12),KQ2(12),KQTYPE(12)                         DAUX55
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          DAUX55
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DAUX55
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      LOGICAL*1 FREE,LDMMY                                              80386
      COMMON/TEMPVS/ C(3,3,600),RHS(3,54),IJK(54,54),IJ,NQ2S            CHGIII
     *               ,IDUM(458),FREE(30),LDMMY(2),DMMY(27859)           80386
      CALL ELTIME(1,30)                                                 DAUX55
      IS - 0                                                            DAUX55
      DO  99  I-1,NGRND                                                 DAUX55
      IF  (ISING(I).LE.0)  GO TO 99                                     DAUX55
      IS - IS+1                                                         DAUX55
      IJ - IJ+1                                                         DAUX55
      IJK(IS   ,IS   ) - IJ                                             DAUX55
      IJK(IS+1,IS+1) - IJ+1                                             DAUX55
      DO 11 J-1,3                                                       DAUX55
      RHS(J,IS   ) - U1(J,I) + W(I)*GRAVTY(J)/G                         DAUX55
      RHS(J,IS+1) - U2(J,I)                                             DAUX55
      U1(J,I) - 0.0                                                     DAUX55
      U2(J,I) - 0.0                                                     DAUX55
      DO 10 K-1,3                                                       DAUX55
      C(J,K,IJ   ) - 0.0                                                DAUX55
   10 C(J,K,IJ+1) - 0.0                                                 DAUX55
      C(J,J,IJ   ) - W(I)/G                                             DAUX55
   11 C(J,J,IJ+1) - PHI(J,I)                                            DAUX55
      IJ - IJ+1                                                         DAUX55
      IF (NFLX.EQ.0) GO TO 19                                           DAUX55
      DO 15 N-1,NFLX                                                    DAUX55
      LN - 0                                                            DAUX55
      IF (NFLEX(1,N).EQ.I) LN - 3*N-2                                   DAUX55
      IF (NFLEX(2,N).EQ.I) LN - 3*N-1                                   DAUX55
      IF (NFLEX(3,N).EQ.I) LN - 3*N                                     DAUX55
      IF (LN.EQ.0) GO TO 15                                             DAUX55
      DO 14 J-1,3                                                       DAUX55
      DO 14 K-1,3                                                       DAUX55
      C(J,K,IJ+1) -  B42(K,J,LN)                                        DAUX55
   14 C(J,K,IJ+2) -  B42(J,K,LN)                                        SLIP
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```
      NNS = 2*NS+N                                                DAUX55
      IJK(IS+1,NNS) = IJ+1                                        DAUX55
      IJK(NNS,IS+1) = IJ+2                                        DAUX55
      IJ = IJ+2                                                   DAUX55
   15 CONTINUE                                                    DAUX55
   19 IF (NQ.EQ.0) GO TO 30                                       DAUX55
      DO 25 N=1,NQ                                                DAUX55
      IF (KQTYPE(N).LT.0) GO TO 25                                DAUX55
      LN = 0                                                      DAUX55
      IF (I.EQ.KQ1(N)) LN = 2*N-1                                 DAUX55
      IF (I.EQ.KQ2(N)) LN = 2*N                                   DAUX55
      IF (LN.EQ.0) GO TO 25                                       DAUX55
      DO 20 J=1,3                                                 DAUX55
      DO 20 K=1,3                                                 DAUX55
      C(J,K,IJ+1) =  A13(J,K,LN)                                  DAUX55
      C(J,K,IJ+2) =  A23(J,K,LN)                                  DAUX55
      C(J,K,IJ+3) =  B31(J,K,LN)                                  SLIP
   20 C(J,K,IJ+4) =  B32(J,K,LN)                                  SLIP
      NNS = 2*NS+NFLX+N                                           DAUX55
      IJK(IS  ,NNS) = IJ+1                                        DAUX55
      IJK(IS+1,NNS) = IJ+2                                        DAUX55
      IJK(NNS,IS  ) = IJ+3                                        DAUX55
      IJK(NNS,IS+1) = IJ+4                                        DAUX55
      IJ = IJ+4                                                   DAUX55
   25 CONTINUE                                                    DAUX55
   30 IF (NJNT.EQ.0) GO TO 98                                     DAUX55
      DO 65 N=1,NJNT                                              DAUX55
      IF (JNT(N).EQ.0) GO TO 65                                   DAUX55
      LN = 0                                                      DAUX55
      IF (I.EQ.IABS(JNT(N))) LN = 2*N-1                           DAUX55
      IF (I.EQ.N+1)          LN = 2*N                             DAUX55
      IF (LN.EQ.0) GO TO 65                                       DAUX55
      SET = 1.0                                                   DAUX55
      IF (I.EQ.N+1) SET = -1.0                                    DAUX55
      DO 40 J=1,3                                                 DAUX55
      DO 40 K=1.3                                                 SLIP
      C(J,K,IJ+1) = SET*A11(J,K,N)                                SLIP
      C(J,K,IJ+3) = SET*A11(K,J,N)                                SLIP
      C(J,K,IJ+2) =  B12(K,J,LN)                                  DAUX55
   40 C(J,J,IJ+4) = B12(J,K,LN)                                   SLIP
      NNS = NQ2S + N                                              DAUX55
      IJK(IS  ,NNS) = IJ+1                                        DAUX55
      IJK(IS+1,NNS) = IJ+2                                        DAUX55
      IJK(NNS,IS  ) = IJ+3                                        DAUX55
      IJK(NNS,IS+1) = IJ+4                                        DAUX55
      IJ = IJ+4                                                   DAUX55
      IF (FREE(N)) GO TO 65                                       SLIP
      DO 60 J=1,3                                                 DAUX55
      DO 60 K=1,3                                                 DAUX55
      C(J,K,IJ+1) =  SET*A22(J,K,LN)                              DAUX55
   60 C(J,K,IJ+2) =  SET*A22(K,J,LN)                              SLIP
      NNS = NQ2S + NJNT + N                                       DAUX55
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```
      IJK(IS+1,NNS) = IJ+1                                   DAUX55
      IJK(NNS,IS+1) = IJ+2                                   DAUX55
      IJ = IJ+2                                              DAUX55
   65 CONTINUE                                               DAUX55
   98 IS = IS+1                                              DAUX55
   99 CONTINUE                                               DAUX55
      CALL ELTIME(2,30)                                      DAUX55
      RETURN                                                 DAUX55
      END                                                    DAUX55
```

```
      SUBROUTINE DHHPIN(DD,BN,L,M,N)                                     DHHPIN
C                                                    REV IV    07/24/86SLIP
C     SETS DD = D(L) IF JOINT M IS NOT PINNED                            DHHPIN
C       OR DD = (I-HH.)(D(L)) IF PINNED                                  DHHPIN
C                                                                        DHHPIN
      IMPLICIT REAL*8 (A-H,O-Z)                                          DHHPIN
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DHHPIN
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)        DHHPIN
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60),  SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),      DHHPIN
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)     DHHPIN
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),        JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                      JDRIFT
      DIMENSION DD(3,3),BN(3)                                            DHHPIN
      DO 10 J=1,3                                                        DHHPIN
      BN(J) = 0.0                                                        DHHPIN
      DO 10 I=1,3                                                        DHHPIN
   10 DD(I,J) = D(I,J,L)                                                 DHHPIN
      LGO = IPIN(M)+8                                                    SLIP
      TSIGN = -1.0                                                       DHHPIN
      GO TO (90,90,90,20,90,90,90,90,30,90,90,90,90,30,30),LGO           SLIP
   20 IF (IEULER(M).GE.7) GO TO 90                                       DHHPIN
      IF (IEULER(M).GE.4) GO TO 30                                       DHHPIN
      TSIGN = 1.0                                                        DHHPIN
      DO 21 J=1,3                                                        DHHPIN
      DO 21 I=1,3                                                        DHHPIN
   21 DD(I,J) = 0.0                                                      DHHPIN
   30 DO 31 J=1,3                                                        DHHPIN
      BN(J) = HB(1,N)*D(1,J,L) + HB(2,N)*D(2,J,L) + HB(3,N)*D(3,J,L)     DHHPIN
      DO 31 I=1,3                                                        DHHPIN
   31 DD(I,J) = DD(I,J) + TSIGN*BN(J)*HB(I,N)                            DHHPIN
   90 RETURN                                                             DHHPIN
      END                                                                DHHPIN
```

```
      SUBROUTINE DINT                                                   DINT
C                                                  REV IV    07/23/86TWOPI
      IMPLICIT REAL*8 (A-H,O-Z)                                         DINT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DINT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/INTEST/ SGTEST(3,4,30),XTEST(360  ),SEGT(120),REGT(120)    DINT
C     NOTE: XTEST SINGLY DIMENSIONED HERE.                              DINT
      REAL    SEGT                                                      DINT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DINT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/CDINT/ UU(4),GH(3,4),                                      DINT
     *              E(3,240), F(5,240),GG(5,240),Y(5,240),U(5,240),     DINT
     *              H,HPRINT,HS,TPRINT,TSTART,ICNT,IDBL,IFLAG,IDMMY     80386
      COMMON/COMAIN/ VAR(240),DER(240),DT,H0,HMAX,HMIN,RSTIME,          DINT
     *               ISTEP,NSTEPS,NDINT,NEQ,IRSIN,IRSOUT                DINT
      LOGICAL LNRT                                                      TGMOD1
      CALL ELTIME(1,3)                                                  DINT
      IF  (ISTEP.NE.0)  GO TO 11                                        DINT
C                                                                       DINT
C     IN=0: INITIAL CALL TO INTEGRATOR - INITIALIZE AND RESET PARAMETERSDINT
C     NOTE: FOR EARLIER VERSIONS OF CVS, THE VARIABLE 'IN'(ISTEP IN THE DINT
C           CALLING PROGRAM) RAN FRON 1 TO NSTEPS+1, NOW IT RUNS FROM   DINT
C           0 TO NSTEPS.                                                DINT
C                                                                       DINT
      TPRINT = TIME                                                     DINT
      IDBL = 2                                                          DINT
      K = 0                                                             DINT
      GO TO 13                                                          DINT
C                                                                       DINT
C     IN#0: ADVANCE TPRINT - TIME TO RETURN TO CALLING PROGRAM.         DINT
C                                                                       DINT
   11 TPRINT = TPRINT + DT                                              DINT
      H = HPRINT                                                        DINT
C                                                                       DINT
C     ENTRY TO ADVANCE INTEGRATOR                                       DINT
C                                                                       DINT
   12 K = 1                                                             DINT
      CALL UPDATE(K)                                                    DINT
C                                                                       DINT
C      NEGATIVE K FROM UPDATE IS INDICATOR TO RESET INTEGRAROR.         DINT
C                                                                       DINT
      IF  (K.EQ.1)  GO TO 15                                            DINT
C                                                                       DINT
C      RESET OR INITIALIZE INTEGRATOR.                                  DINT
C                                                                       DINT
   13 H = H0                                                            DINT
      HPRINT = H0                                                       DINT
      HS = 0.0                                                          DINT
      ICNT = -2                                                         DINT
      IF  (ISTEP.EQ.0  .OR. NPRT(26).EQ.2)  CALL OUTPUT(0)              DINT
      CALL PDAUX (VAR,DER,NEQ,K)                                        DINT
      IF  (ISTEP.NE.0 .AND. NPRT(26).EQ.2)  CALL OUTPUT(1)              DINT
```

```
      DO  14  I=1,NEQ                                                   DINT
      F(1,I) = VAR(I)                                                   DINT
      F(2,I) = DER(I)                                                   DINT
      DO  14  J=3,5                                                     DINT
      F(J,I) = 0.0                                                      DINT
      U(J,I) = 0.0                                                      DINT
   14 Y(J,I) = 0.0                                                      DINT
      IF  (ISTEP.EQ.0)  GO TO 65                                        DINT
      K = 1                                                             DINT
C                                                                       DINT
C     ADJUST H (CURRENT TIME STEP) IF IT WILL ADVANCE T BEYOND TPRINT.  DINT
C                                                                       DINT
   15 IF  (H+EPS(8).GE.TPRINT-TIME)  H = TPRINT-TIME                    DINT
C                                                                       DINT
C     BACKUP ENTRY POINT IF H HAS BEEN HALVED.                          DINT
C                                                                       DINT
   16 D1 = 0.5*H                                                        DINT
      CALL TRIGFS                                                       DINT
      TSTART = TIME                                                     DINT
      DO  20  I=1,NEQ                                                   DINT
      U(3,I) = Y(5,I)                                                   DINT
      U(4,I) = U(5,I)                                                   DINT
      DO  20  J=1,5                                                     DINT
   20 GG(J,I) = F(J,I)                                                  DINT
      CALL CMPUTE (K,1,D1)                                              DINT
      IF (K.LT.0)  GO TO 50                                             DINT
      CALL ADJUST   (1,D1)                                              DINT
      K = 2                                                             DINT
      CALL CMPUTE (K,0,D1)                                              DINT
      IF (K.LT.0)  GO TO 50                                             DINT
      CALL ADJUST   (2,D1)                                              DINT
      NQUAT = K                                                         DINT
      K = 3                                                             DINT
      CALL CMPUTE (K,1, H)                                              DINT
      IF (K.LT.0)  GO TO 50                                             DINT
      CALL ADJUST   (3,D1)                                              DINT
      DO  49  L=1,NDINT                                                 DINT
      M = 1                                                             DINT
      IF  (L.EQ.1)  M = 0                                               DINT
      IF  (NPRT(26).NE.2)  CALL OUTPUT(0)                               DINT
      CALL CMPUTE (K,M, H)                                              DINT
      IF (K.LT.0)  GO TO 50                                             DINT
      FAIL = 1.0                                                        DINT
      JJ = 0                                                            DINT
      DO  47  II=1,NEQ,3                                                DINT
      JJ = JJ+1                                                         DINT
      IF  (XTEST(II).LE.0.0)  GO TO 47                                  DINT
      TT = DER(II)**2 + DER(II+1)**2 + DER(II+2)**2                     DINT
      TX = VAR(II)**2 + VAR(II+1)**2 + VAR(II+2)**2                     DINT
      TE = 0.0                                                          DINT
      TY = 0.0                                                          DINT
      I2 = II+2                                                         DINT
```

```
      DO  45  I=II,I2                                                 DINT
      Z = GG(5,I)*(VAR(I)-GG(1,I)) + GG(2,I) + H*(GG(3,I)+H*GG(4,I))  DINT
      TE = TE + (DER(I)-Z)**2                                         DINT
      TYD = TT + TX*GG(5,I)**2                                        DINT
      IF  (TYD.EQ.0.0)  TYD = 1.0                                     DINT
   45 TY = TY + (DER(I)-Z)**2/TYD                                     DINT
      TM = 1000.0*TIME                                                DINT
      IF  (NPRT(25).NE.0)  WRITE (6,46) TM,SEGT(JJ),REGT(JJ),TT,TE,TY, DINT
     *                                  (XTEST(I),I=II,I2)            DINT
   46 FORMAT ('0 DINT CONV. TEST',F10.3,2X.A4,2X,A8,6G12.4)           DINT
      IF  (TT.LT.XTEST(II))  GO TO 47                                 DINT
      IF  (XTEST(II+1).GT.0.0 .AND. TE.LT.XTEST(II+1))  GO TO 47      DINT
      IF  (TY.GT.XTEST(II+2))  GO TO 48                               DINT
   47 CONTINUE                                                        DINT
      FAIL = 0.0                                                      DINT
   48 CALL ADJUST   (4,D1)                                            DINT
      IF  (FAIL.EQ.0.0)  GO TO 60                                     DINT
      IF  (L.EQ.NDINT)   GO TO 49                                     DINT
      CALL CMPUTE (K,1,D1)                                            DINT
      IF  (K.LT.0)         GO TO 50                                   DINT
      CALL ADJUST   (5,D1)                                            DINT
   49 CONTINUE                                                        DINT
      IF  (NPRT(25).EQ.0)  WRITE (6,46) TM,SEGT(JJ),REGT(JJ),TT,TE,TY, DINT
     *                                  (XTEST(I),I=II,I2)            DINT
   50 WRITE  (6,51)  TIME,H                                           DINT
   51 FORMAT('0 TEST FAILED AT TIME = ',F10.6,' FOR H = ',F10.6)      DINT
      ICNT = 0                                                        DINT
      IDBL = IDBL+2                                                   DINT
      IF  (IDBL.GT.6)  IDBL = 6                                       DINT
      IF  (K.GE.0)  GO TO 58                                          D . .
      IF  (H.GT.HMIN+EPS(8))  GO TO 59                                DINT
      WRITE  (6,52)                                                   DINT
   52 FORMAT('0 PROGRAM TERMINATED. PDAUX NEG SQRT. H < HMIN+EPS8.'/  DINT
     *       '  RERUN PROGRAM WITH SMALLER HMIN ON INPUT CARD A.4')   DINT
      STOP 31                                                         DINT
   58 IF  (H.LE.HMIN+EPS(8))  GO TO 61                                DINT
      IF  (NPRT(26).EQ.2)  CALL OUTPUT(1)                             DINT
   59 TIME = TSTART                                                   DINT
      H = 0.5*H                                                       DINT
      HPRINT = 0.5*HPRINT                                             DINT
      K = 2                                                           DINT
      GO TO 16                                                        DINT
   60 IF  (H.GT.0.74*HPRINT)  ICNT = ICNT+1                           DINT
   61 K = 4                                                           DINT
      M = 0                                                           DINT
      IF  (H.GT.HMIN .AND. IDBL.GT.2)  IDBL = IDBL-1                  DINT
      GG4 = 2.0*H                                                     DINT
      GG5 = DEXP(-1600.0*H)                                           DINT
      DO  63  I=1,NEQ                                                 DINT
      F(3,I) = GG(3,I) + GG4*GG(4,I)                                  DINT
      F(4,I) = GG(4,I)                                                DINT
      F(5,I) = GG(5,I)                                                DINT
```

```
      Y(3,I) = Y(1,I)                                             DINT
      Y(4,I) = Y(2,I)                                             DINT
      Y(5,I) = GG5*U(3,I)                                         DINT
   63 U(5,I) = GG5*U(4,I)                                         DINT
      CALL QSET(F,Y,VAR,DER,NQUAT)                                DINT
      CALL PDAUX (VAR,DER,M,K)                                    DINT
      DO  64  I=1,NEQ                                             DINT
      F(1,I) = VAR(I)                                             DINT
   64 F(2,I) = DER(I)                                             DINT
      HS = H                                                      DINT
      IF  (ICNT.LT.IDBL)  GO TO 65                                DINT
      ICNT = 0                                                    DINT
      H = DMIN1(2.0*H,HMAX)                                       DINT
      HPRINT = DMIN1(2.0*HPRINT,HMAX)                             DINT
   65 CALL UPDATE(2)                                              DINT
      XPRINT = TPRINT - TIME                                      TGMOD1
      IF(XPRINT.GE.EPS(8).AND.NPRT(26).NE.3.AND.NPRT(26).GE.0)    TGMOD1
     * CALL OUTPUT(1)                                             TGMOD1
      IF(XPRINT.GE.EPS(8)) GO TO 12                               TGMOD1
      LNRT = .FALSE.                                              TGMOD1
      IF(NPRT(26).GE.0) LNRT = .TRUE.                             TGMOD1
      IF(NPRT(26).LT.0) INRT = IABS(NPRT(26))                     TGMOD1
      IF(NPRT(26).LT.0) LNRT = (MOD(ISTEP,INRT).EQ.0)             TGMOD1
      IF(LNRT) CALL OUTPUT(1)                                     TGMOD1
      CALL ELTIME(2,3)                                            DINT
      RETURN                                                      DINT
      END                                                         DINT
```

```
      SUBROUTINE DOTT31 (A,B,C)                                         DOTT31
C                                                   REV 17    12/20/76DOTT31
C     PERFORMS MATRIX MULTIPLICATION C = AB'                            DOTT31
C     WHERE C IS A 3X3 MATRIX, AND A AND B ARE VECTORS OF LENGTH 3.     DOTT31
C                                                                       DOTT31
      IMPLICIT REAL*8 (A-H,O-Z)                                         DOTT31
      DIMENSION  A(3) , B(3) , C(3,3)                                   DOTT31
      DO  10  I=1,3                                                     DOTT31
      DO  10  J=1,3                                                     DOTT31
   10 C(I,J) = A(I)*B(J)                                                DOTT31
      RETURN                                                            DOTT31
      END                                                               DOTT31
```

```
      SUBROUTINE DOTT33 (A,B,C)                                          DOTT33
C                                                   REV 17    01/03/77DOTT33
C     PERFORMS MATRIX MULTIPLICATION C = AB'                             DOTT33
C     WHERE A, B AND C ARE ALL 3X3 MATRICEES.                            DOTT33
C                                                                        DOTT33
      IMPLICIT REAL*8 (A-H,O-Z)                                          DOTT33
      DIMENSION  A(3,3) , B(3,3) , C(3,3)                                DOTT33
      DO  10  I=1,3                                                      DOTT33
      DO  10  J=1,3                                                      DOTT33
   10 C(I,J) = A(I,1)*B(J,1) + A(I 2)*B(J,2) + A(I,3)*B(J,3)             DOTT33
      RETURN                                                             DOTT33
      END                                                                DOTT33
```

```
      SUBROUTINE DOT31 (A,B,C)                                          DOT31
C                                                 REV 17    01/03/77DOT31
C     PERFORMS MATRIX MULTIPLICATION C = A'B                            DOT31
C     WHERE A IS A 3X3 MATRIX, AND B AND C ARE VECTORS OF LENGTH 3.     DOT31
C                                                                       DOT31
      IMPLICIT REAL*8 (A-H,O-Z)                                         DOT31
      DIMENSION  A(3,3) , B(3) , C(3)                                   DOT31
      C(1) = A(1,1)*B(1) + A(2,1)*B(2) + A(3,1)*B(3)                    DOT31
      C(2) = A(1,2)*B(1) + A(2,2)*B(2) + A(3,2)*B(3)                    DOT31
      C(3) = A(1,3)*B(1) + A(2,3)*B(2) + A(3,3)*B(3)                    DOT31
      RETURN                                                            DOT31
      END                                                               DOT31
```

```
      SUBROUTINE DOT33 (A,B,C)                                          DOT33
C                                                   REV 17    01/03/77DOT33
C     PERFORMS MATRIX MULTIPLICATION C = A'B                            DOT33
C     WHERE A, B AND C ARE ALL 3X3 MATRICEES.                           DOT33
C                                                                       DOT33
      IMPLICIT REAL*8 (A-H,O-Z)                                         DOT33
      DIMENSION  A(3,3) , B(3,3) , C(3,3)                               DOT33
      DO  10  I=1,3                                                     DOT33
      DO  10  J=1,3                                                     DOT33
   10 C(I,J) = A(1,I)*B(1,J) + A(2,I)*B(2,J) + A(3,I)*B(3,J)            DOT33
      RETURN                                                            DOT33
      END                                                               DOT33
```

```
      SUBROUTINE DRCIJK (D,ANG,ID,HT,J)                                 DRCIJK
C                                                   REV 18    02/24/78DRCIJK
      IMPLICIT REAL*8 (A-H,O-Z)                                         DRCIJK
      DIMENSION  D(9,22),HT(9,42),ANG(3,22),ID(4,22),T1(9).T2(9)        DRCIJK
      M = ID(4,J)                                                       DRCIJK
      IF  (M.NE.0)  GO TO 10                                            DRCIJK
      CALL DRCYPR (D(1,J),ANG(1,J),ID(1,J))                             DRCIJK
      GO TO 99                                                          DRCIJK
   10 CALL DRCYPR (T1,ANG(1,J),ID(1,J))                                 DRCIJK
      IF  (M.LT.0)  GO TO 20                                            DRCIJK
      CALL MAT33 (T1,D(1,M),D(1,J))                                     DRCIJK
      GO TO 99                                                          DRCIJK
   20 M = -M                                                            DRCIJK
      CALL DOT33 (HT(1,2*J-3),D(1,M),D(1,J))                            DRCIJK
      CALL MAT33 (T1,D(1,J),T2)                                         DRCIJK
      CALL MAT33 (HT(1,2*J-2),T2,D(1,J))                                DRCIJK
   99 RETURN                                                            DRCIJK
      END                                                               DRCIJK
```

```
      SUBROUTINE DRCQUA(DC,Q)                                           DRCQUA
C                                                  REV III.5 07/31/85JTF785
C     COMPUTES DIRECTION COSINE MATRIX FROM QUATERNIONS                 DRCQUA
      IMPLICIT REAL*8(A-H,O-Z)                                          DRCQUA
      DIMENSION DC(3,3),Q(4)                                            DRCQUA
      C = Q(1)**2 - Q(2)**2 - Q(3)**2 - Q(4)**2                         JTF785
      DO 12 I = 1,3                                                     DRCQUA
      DO 10 J = 1,3                                                     DRCQUA
   10 DC(I,J) = 2.0*Q(I+1)*Q(J+1)                                       DRCQUA
   12 DC(I,I) = DC(I,I) + C                                             DRCQUA
      E = Q(1) + Q(1)                                                   DRCQUA
      DO 14 I = 1,3                                                     DRCQUA
      J = 1 + MOD(I,3)                                                  DRCQUA
      K = 1 + MOD(I+1,3)                                                DRCQUA
      D = E*Q(I+1)                                                      DRCQUA
      DC(K,J) = DC(K,J) - D                                             DRCQUA
   14 DC(J,K) = DC(J,K) + D                                             DRCQUA
      DO 18 I =1,3                                                      DRCQUA
      DO 18 J = 1,3                                                     DRCQUA
   18 IF(DABS(DC(I,J)).GT.1.0D0)DC(I,J) = DSIGN(1.0D0,DC(I,J))          DRCQUA
      RETURN                                                            DRCQUA
      END                                                               DRCQUA
```

```
      SUBROUTINE DRCYPR (D,A,ID)                                        DRCYPR
C                                                    REV IV    07/23/86TWOPI
C     SETS UP 3X3 DIRECTION COSINE MATRIX FOR GIVEN YAW,PITCH AND ROLL. DRCYPR
C                                                                       DRCYPR
C       ARGUMENTS:                                                      DRCYPR
C         D: 3X3 DIRECTION COSINE MATRIX TO BE COMPUTED.                DRCYPR
C         A: ARRAY OF LENGTH 3 CONTAINING ROTATATION ANGLES (DEGREES).  DRCYPR
C        I1: AXIS OF ROTATION FOR 1ST ANGLE (1,2,3 = X,Y,Z)             DRCYPR
C        I2: AXIS OF ROTATION FOR 2ND ANGLE (1,2,3 = X,Y,Z)             DRCYPR
C        I3: AXIS OF ROTATION FOR 3RD ANGLE (1,2,3 = X,Y,Z)             DRCYPR
C                                                                       DRCYPR
      IMPLICIT REAL*8 (A-H,O-Z)                                         DRCYPR
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DRCYPR
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      DIMENSION D(3,3),A(3),ID(3),T(3,3),B(3),S(3)                      DRCYPR
      IDSUM = ID(1) + ID(2) + ID(3)                                     DRCYPR
      DO  12  I=1,3                                                     DRCYPR
      B(I) = A(I)*RADIAN                                                DRCYPR
      DO  11  J=1,3                                                     DRCYPR
   11 D(I,J) = 0.0                                                      DRCYPR
   12 D(I,I) = 1.0                                                      DRCYPR
      DO  30  N=1,3                                                     DRCYPR
      IDN = IABS(ID(N))                                                 DRCYPR
      M = 4 - IDN                                                       DRCYPR
      IF  (ID(N).LT.0)  M = IDSUM - ID(N) - 2                           DRCYPR
      IF  (B(M).EQ.0.0)  GO TO 30                                       DRCYPR
      CALL ROT (T,IDN,B(M))                                             DRCYPR
      DO  23  J=1,3                                                     DRCYPR
      DO  21  K=1,3                                                     DRCYPR
      S(K) = D(K,J)                                                     DRCYPR
   21 D(K,J) = 0.0                                                      DRCYPR
      DO  22  I=1,3                                                     DRCYPR
      DO  22  K=1,3                                                     DRCYPR
   22 D(I,J) = D(I,J) + T(I,K)*S(K)                                     DRCYPR
   23 CONTINUE                                                          DRCYPR
   30 CONTINUE                                                          DRCYPR
      RETURN                                                            DRCYPR
      END                                                               DRCYPR
```

```
      SUBROUTINE DRIFT                                                  DRIFT
C                                                  REV IV    07/24/86SLIP
C     CORRECTS FOR DRIFT IN CONSTRAINED JOINTS                          DRIFT
C                                                                       DRIFT
C                                                                       DRIFT
      IMPLICIT REAL*8(A-H,O-Z)                                          DRIFT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           DRIFT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    DRIFT
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),DRIFT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       DRIFT
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     DRIFT
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    DRIFT
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       DRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     DRIFT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DRIFT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TEMPVS/ T1(3),T2(3),T3(3),T4(3),TP(3,3),H1(3),H2(3)        DRIFT
     *            ,DMMY(35086)                                          80386
      IF (NJNT.EQ.0) GO TO 51                                           DRIFT
      DO 50 J=1,NJNT                                                    DRIFT
      K = IABS(JNT(J))                                                  DRIFT
      IF (K.EQ.0) GO TO 50                                              DRIFT
      IF (ISING(J+1).LT.0) GO TO 50                                     DRIFT
C                                                                       DRIFT
      M = 0                                                             DRIFT
      IF (IPIN(J).EQ.1)   M = 4                                         DRIFT
      IF (IPIN(J).EQ.6)  M = 4                                          SLIP
      IF (IPIN(J).EQ.7)  M = 4                                          SLIP
      IF (IABS(IPIN(J)).NE.4)  GO TO 15                                 DRIFT
      IF (IEULER(J).EQ.1)  M = 2                                        DRIFT
      IF (IEULER(J).EQ.2)  M = 3                                        DRIFT
      IF (IEULER(J).EQ.3)  M = 1                                        DRIFT
      IF (IEULER(J).EQ.4)  M = 4                                        DRIFT
      IF (IEULER(J).EQ.5)  M = 4                                        DRIFT
      IF (IEULER(J).EQ.6)  M = 4                                        DRIFT
   15 IF (M.EQ.0) GO TO 50                                              DRIFT
      IF(M.EQ.4)GO TO 23                                                DRIFT
      IF(M.NE.3)GO TO 21                                                DRIFT
      CALL EJOINT(-1,J)                                                 DRIFT
      CALL CROSS(HIR(1,2,2*J+29),HIR(1,1,2*J+29),T1)                    DRIFT
      DO 17 I = 1,3                                                     DRIFT
      H1(I) = CONST(4,J)*HIR(I,1,2*J+29) + CONST(5,J)*T1(I)             DRIFT
   17 H2(I) = HIR(I,3,2*J+30)                                           DRIFT
      GO TO 25                                                          DRIFT
   21 DO 22 I = 1,3                                                     DRIFT
      H1(I) = HIR(I,M,2*J+29)                                           DRIFT
   22 H2(I) = HIR(I,M+1,2*J+30)                                         DRIFT
      GO TO 25                                                          DRIFT
   23 DO 24 I = 1,3                                                     DRIFT
      H1(I) = HB(I,2*J-1)                                               DRIFT
   24 H2(I) = HB(I,2*J)                                                 DRIFT
```

```
C                                                                      DRIFT
C      **  ADJUST DC MATRIX FOR CONSTRAINED JOINTS  **                 DRIFT
C                                                                      DRIFT
   25 CALL DOT31(D(1,1,K),H1,T1)                                       DRIFT
      CALL MAT31 (D(1,1,J+1),T1,T2)                                    DRIFT
      CT = T2(1)*H2(1) + T2(2)*H2(2) + T2(3)*H2(3)                     DRIFT
      IF(M.GE.3)GO TO 28                                               DRIFT
      ST = 1.0/DSQRT((1.0 - CT)*(1.0 + CT))                            DRIFT
      DO 27 I = 1,3                                                    DRIFT
   27 T2(I) = (H2(I) - CT*T2(I))*ST                                    DRIFT
      CT = 1.0/ST                                                      DRIFT
   28 CALL CROSS(H2,T2,T3)                                             DRIFT
      DO 30 L=1,3                                                      DRIFT
      CALL CROSS (T3,D(1,L,J+1),T4)                                    DRIFT
      ST = T3(1)*D(1,L,J+1) + T3(2)*D(2,L,J+1) + T3(3)*D(3,L,J+1)      DRIFT
      ST = ST/(1.0 + CT)                                               DRIFT
      DO 30 I=1,3                                                      DRIFT
   30 D(I,L,J+1) = CT*D(I,L,J+1) - T4(I) + ST*T3(I)                    DRIFT
C                                                                      DRIFT
C      **  RENORMALIZATION OF DIRECTION COSINE MATRIX BY **            DRIFT
C      **  AVERAGING MATRIX AND TRANSPOSE OF ITS INVERSE **            DRIFT
C                                                                      DRIFT
      DO 33 ITER= 1,10                                                 DRIFT
      CALL CFACTT (D(1,1,J+1),TP,DET)                                  DRIFT
      DO 32 L = 1,3                                                    DRIFT
      DO 32 I = 1,3                                                    DRIFT
      D(I,L,J+1) = 0.5*(D(I,L,J+1)+TP(L,I)/DET)                        DRIFT
   32 IF (DABS(D(I,L,J+1)).LT.EPS(15)) D(I,L,J+1) = 0.0                DRIFT
      IF (DABS(DET-1.0).LT.EPS(6)) GO TO 41                            DRIFT
   33 CONTINUE                                                         DRIFT
      WRITE (6,34) J,TIME,DET                                          DRIFT
   34 FORMAT (44H0 DRIFT RENORMALIZATION DID NOT CONVERGE FOR,         DRIFT
     *        10H JOINT NO.,I3,7H TIME =,F10.6,6H DET =,F10.6)         DRIFT
C                                                                      DRIFT
C      **  ADJUST WMEG FOR CONSTRAINED JOINTS  **                      DRIFT
C                                                                      DRIFT
   41 IF(M.NE.4)GO TO 43                                               DRIFT
      HW = H2(1)*WMEG(1,J+1) - H1(1)*WMEG(1,K)                         DRIFT
     *   + H2(2)*WMEG(2,J+1) - H1(2)*WMEG(2,K)                         DRIFT
     *   + H2(3)*WMEG(3,J+1) - H1(3)*WMEG(3,K)                         DRIFT
      CALL DOT31 (D(1,1,K),WMEG(1,K),T1)                               DRIFT
      CALL MAT31 (D(1,1,J+1),T1,WMEG(1,J+1))                           DRIFT
      DO 42 I=1,3                                                      DRIFT
   42 WMEG(I,J+1) = WMEG(I,J+1) + HW*H2(I)                             DRIFT
      GO TO 50                                                         DRIFT
   43 IF(M.NE.3)GO TO 47                                               DRIFT
      CALL DOT31(D(1,1,K),HIR(1,2,2*J+29),T1)                          DRIFT
      CALL MAT31(D(1,1,J+1),T1,H1)                                     DRIFT
      GO TO 48                                                         DRIFT
   47 CALL MAT31(D(1,1,J+1),T1,T2)                                     DRIFT
      CALL CROSS(T2,H2,H1)                                             DRIFT
   48 CALL DOT31(D(1,1,K),WMEG(1,K),T1)                                DRIFT
```

```
      CALL MAT31(D(1,1,J+1),T1,T2)                                      DRIFT
      HW = H1(1)*(T2(1) - WMEG(1,J+1))                                  DRIFT
     *   + H1(2)*(T2(2) - WMEG(2,J+1))                                  DRIFT
     *   + H1(3)*(T2(3) - WMEG(3,J+1))                                  DRIFT
      DO 49 I = 1,3                                                     DRIFT
   49 WMEG(I,J+1) = WMEG(I,J+1) + HW*H1(I)                              DRIFT
   50 CONTINUE                                                          DRIFT
   51 RETURN                                                            DRIFT
      END                                                               DRIFT
```

```
      SUBROUTINE DSETD(D,TH,T)                                          DSETD
C                                                 REV IV    07/23/86TWOPI
C     UPDATES A DIRECTION COSINE MATRIX (D)                             DSETD
C     USING AN INCREMENTAL ANGULAR MOTION (TH).                         DSETD
C         ARGUMENTS D: 3X3 DIRECTION COSINE MATRIX TO BE UPDATED.       DSETD
C                  TH: 3 COMPONENTS OF INCREMENTAL ANGULAR MOTION       DSETD
C                      ABOUT LOCAL X,Y AND Z AXIS RESPECTIVELY.         DSETD
C                   T: MAGNITUDE OF VECTOR TH COMPUTED BY ROUTINE.      DSETD
C                                                                       DSETD
       IMPLICIT REAL*8(A-H,O-Z)                                         DSETD
      DIMENSION D(3,3),TH(3),S(3),TEMP(3,3)                             DSETD
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DSETD
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
       T=DSQRT(TH(1)**2+TH(2)**2+TH(3)**2)                              DSETD
       IF(T.EQ.0.)RETURN                                                DSETD
       ST=DSIN(T)                                                       DSETD
       CT=DCOS(T)                                                       DSETD
       STT=ST/T                                                         DSETD
       CTT=STT**2/(1.+CT)                                               DSETD
       DO 10 J=1,3                                                      DSETD
       S(1)=-TH(3)*D(2,J)+TH(2)*D(3,J)                                  DSETD
       S(2)= TH(3)*D(1,J)-TH(1)*D(3,J)                                  DSETD
       S(3)=-TH(2)*D(1,J)+TH(1)*D(2,J)                                  DSETD
       DTT=(TH(1)*D(1,J)+TH(2)*D(2,J)+TH(3)*D(3,J))*CTT                 DSETD
       DO 5 K=1,3                                                       DSETD
    5  D(K,J)=D(K,J)*CT-STT*S(K)+TH(K)*DTT                              DSETD
   10  CONTINUE                                                         DSETD
C                                                                       DSETD
C     RENORMALIZATION OF DIRECTION COSINE MATRIX                        DSETD
C     BY AVERAGING MATRIX AND TRANSPOSE OF ITS INVERSE.                 DSETD
C                                                                       DSETD
      DO 23 ITER=1,10                                                   DSETD
      CALL CFACTT(D,TEMP,DET)                                           DSETD
      DO 22 I=1,3                                                       DSETD
      DO 22 J=1,3                                                       DSETD
      D(I,J) = 0.5*(D(I,J)+TEMP(J,I)/DET)                               DSETD
   22 IF (DABS(D(I,J)).LT.EPS(15)) D(I,J)=0.0                           DSETD
      IF (DABS(DET-1.0).LT.EPS(6)) GO TO 24                             DSETD
   23 CONTINUE                                                          DSETD
      WRITE (6,27) DET                                                  DSETD
   27 FORMAT('0 DSETD RENORMALIZATION DID NOT CONVERGE, DET =',1PD25.15)DSETD
   24 RETURN                                                            DSETD
      END                                                               DSETD
```

```
      SUBROUTINE DSETQ(E,TH,ES,EC,D)                                    DSETQ
C                                                 REV IV    07/23/86TWOPI
C     COMPUTES NEW DIRECTION MATRIX (D), GIVEN ORIGINAL MATRIX (E)      DSETQ
C     AND INCREMENTAL MOTION EXPRESSED IN QUATERNION FORM.              DSETQ
C                                                                       DSETQ
C       ARGUMENTS:                                                      DSETQ
C                                                                       DSETQ
C              E : ORIGINAL DIRECTION COSINE MATRIX.                    DSETQ
C             TH : COMPONENTS OF Q ( UX SIN A/2, UY SIN A/2, UZ SIN A/2) DSETQ
C             ES : SIN**2(A/2)                                          DSETQ
C             EC : COS (A/2)                                            DSETQ
C              D : NEW DIRECTION COSINE MATRIX.                         DSETQ
C                                                                       DSETQ
       IMPLICIT REAL*8(A-H,O-Z)                                         DSETQ
      DIMENSION D(3,3),TH(3),S(3),TEMP(3,3),E(3,3)                      DSETQ
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DSETQ
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      CT = 1.0 - 2.0*ES                                                 DSETQ
      DO 10 J=1,3                                                       DSETQ
      S(1) = TH(2)*E(3,J) - TH(3)*E(2,J)                                DSETQ
      S(2) = TH(3)*E(1,J) - TH(1)*E(3,J)                                DSETQ
      S(3) = TH(1 *E(2,J) - TH(2)*E(1,J)                                DSETQ
      DTT = TH(1)*E(1,J) + TH(2)*E(2,J) + TH(3)*E(3,J)                  DSETQ
      DO 5 K=1,3                                                        DSETQ
    5 D(K,J) = E(K,J)*CT + 2.0*(TH(K)*DTT - EC*S(K))                    DSETQ
   10  CONTINUE                                                         DSETQ
C                                                                       DSETQ
C     RENORMALIZATION OF DIRECTION COSINE MATRIX                        DSETQ
C     BY AVERAGING MATRIX AND TRANSPOSE OF ITS INVERSE.                 DSETQ
C                                                                       DSETQ
      DO 23 ITER=1,10                                                   DSETQ
      CALL CFACTT(D,TEMP,DET)                                           DSETQ
      DO 22 I=1,3                                                       DSETQ
      DO 22 J=1,3                                                       DSETQ
      D(I,J) = 0.5*(D(I,J)+TEMP(J,I)/DET)                               DSETQ
   22 IF (DABS(D(I,J)).LT.EPS(15)) D(I,J)=0.0                           DSETQ
      IF (DABS(DET-1.0).LT.EPS(6)) GO TO 24                             DSETQ
   23 CONTINUE                                                          DSETQ
      WRITE (6,27) DET                                                  DSETQ
   27 FORMAT('0 DSETQ RENORMALIZATION DID NOT CONVERGE, DET =',1PD25.15)DSETQ
   24 RETURN                                                            DSETQ
      END                                                               DSETQ
```

```
      SUBROUTINE DSMSOL (A,KK,LL)                                       DSMSOL
C                                                   REV 03    07/08/74DSMSOL
C     SOLVES A SET OF SIMULTANEOUS LINEAR EQUATIONS AX=B.               DSMSOL
C                                                                       DSMSOL
C       ARGUMENTS:                                                      DSMSOL
C         A: 2-DIMENSIONAL(KK,KK+1) MATRIX OF COEFFICIENTS.             DSMSOL
C         KK: NUMBER OF EQUATIONS AND UNKNOWNS.                         DSMSOL
C         LL: 1ST DIMENSION OF A IN CALLING PROGRAM.                    DSMSOL
C                                                                       DSMSOL
C       CALLING PROGRAM SETUP:                                          DSMSOL
C         A(I,J) FOR I,J=1,KK                                           DSMSOL
C         A(I,KK+1) = B(I) FOR I=1,KK                                   DSMSOL
C         THE SOLUTION X IS RETURNED IN COLUMN KK+1 OF A.               DSMSOL
C         MATRIX A IS DESTROYED BY SUBROUTINE.                          DSMSOL
C                                                                       DSMSOL
      IMPLICIT REAL*8(A-H,O-Z)                                          DSMSOL
      DIMENSION A(LL,1)                                                 DSMSOL
      N  = KK                                                           DSMSOL
      N1 = N+1                                                          DSMSOL
      DO 50  L=1,N                                                      DSMSOL
      L1 = L+1                                                          DSMSOL
      BIG = 0.0                                                         DSMSOL
      DO 25  I=L,N                                                      DSMSOL
      IF (DABS(A(I,L)).LE.DABS(BIG)) GO TO 25                           DSMSOL
      K = I                                                             DSMSOL
      BIG = A(I,L)                                                      DSMSOL
   25 CONTINUE                                                          DSMSOL
      IF (BIG.NE.0.0) GO TO 30                                          DSMSOL
      WRITE (6,26)                                                      DSMSOL
   26 FORMAT('0 DSMSOL MATRIX SINGULAR, PROGRAM TERMINATED.')           DSMSOL
      STOP  41                                                          DSMSOL
   30 BIG = 1.0/BIG                                                     DSMSOL
      DO 40  J=L,N1                                                     DSMSOL
      B      = A(K,J)                                                   DSMSOL
      A(K,J) = A(L,J)                                                   DSMSOL
   40 A(L,J) = B*BIG                                                    DSMSOL
      IF (L.EQ.N) GO TO 50                                              DSMSOL
      DO 48  I=L1,N                                                     DSMSOL
      IF (A(I,L).EQ.0.0) GO TO 48                                       DSMSOL
      DO 45  J=L1,N1                                                    DSMSOL
   45 A(I,J) = A(I,J)-A(I,L)*A(L,J)                                     DSMSOL
   48 CONTINUE                                                          DSMSOL
   50 CONTINUE                                                          DSMSOL
      IF (N.EQ.1) GO TO 71                                              DSMSOL
      N2 = N-1                                                          DSMSOL
      DO 60  L=1,N2                                                     DSMSOL
      I  = N-L                                                          DSMSOL
      L1 = I+1                                                          DSMSOL
      DO 60  J=L1,N                                                     DSMSOL
   60 A(I,N1) = A(I,N1)-A(I,J)*A(J,N1)                                  DSMSOL
   71 CONTINUE                                                          DSMSOL
      RETURN                                                            DSMSOL
```

END DSMSOL

```
      SUBROUTINE DZP(N,X,GG,E,R,M)                                      DZP
C                                                     REV IV   07/23/86TWOPI
C     COMPUTES THE STATE VARIABLES (X) FROM THE PARAMETRIC FORM ASSUMED DZP
C     IN THE INTEGRATION ROUTINE DINT. ALSO EVALUATES THE EXPONENTIAL   DZP
C     WEIGHTS (E) IF M IS NOT ZERO.                                     DZP
C                                                                       DZP
      IMPLICIT REAL*8 (A-H,O-Z)                                         DZP
      DIMENSION X(1),GG(5,1),E(3,1)                                     DZP
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         DZP
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
C                                                                       DZP
      CALL ELTIME(1,5)                                                  DZP
      IF(M.NE.0) GO TO 10                                               DZP
C                                                                       DZP
C     COMPUTE STATE VARIABLES ONLY.                                     DZP
C                                                                       DZP
      DO 5  I=1,N                                                       DZP
    5  X(I) = GG(1,I) + R*(GG(2,I)*E(1,I)                               DZP
     *                 + R*(GG(3,I)*E(2,I)                              DZP
     *                 + R*(GG(4,I)*E(3,I) )))                          DZP
      GO TO 90                                                          DZP
C                                                                       DZP
C     COMPUTE EXPONENTIAL WEIGHTS AND STATE VARIABLES.                  DZP
C                                                                       DZP
   10 DO 50  I=1,N                                                      DZP
      E(1,I) = 1.0                                                      DZP
      E(2,I) = 0.5                                                      DZP
      E(3,I) = THIRD                                                    DZP
      IF (GG(5,I).EQ.0.0) GO TO 50                                      DZP
      Z = R*GG(5,I)                                                     DZP
      W = 0.                                                            DZP
      IF (DABS(Z).GT.0.004) GO TO 20                                    DZP
      W = 4.                                                            DZP
      A = E(3,I)                                                        DZP
      E(3,I) = 0.                                                       DZP
   15 E(3,I) = E(3,I)+A                                                 DZP
      A = A*Z/W                                                         DZP
      W = W+1.0                                                         DZP
      IF(E(3,I)+A.NE.E(3,I)) GO TO 15                                   DZP
      E(2,I) = 0.5+0.5*Z*E(3,I)                                         DZP
      E(1,I) = 1.+Z*E(2,I)                                              DZP
      GO TO 50                                                          DZP
   20 IF(Z.GT.-40.) W = DEXP(Z)                                         DZP
      E(1,I) = (W-1.)/Z                                                 DZP
      E(2,I) = (E(1,I)-1.)/Z                                            DZP
      E(3,I) = (2.*E(2,I)-1.)/Z                                         DZP
   50  X(I) = GG(1,I) + R*(GG(2,I)*E(1,I)                               DZP
     *                 + R*(GG(3,I)*E(2,I)                              DZP
     *                 + R*(GG(4,I)*E(3,I) )))                          DZP
C                                                                       DZP
   90 CALL ELTIME(2,5)                                                  DZP
      RETURN                                                            DZP
```

END

DZP

```
      SUBROUTINE EDEPTH (A,B,XM,T,Y,XA,XB,XL,XU)                        EDEPTH
C                                                REV IV    07/23/86TWOPI
C     DETERMINES XA AND XB, THE POINTS OF MAXIMUM PENETRATION OF TWO    EDEPTH
C     INTERSECTING ELLIPSOIDS A AND B.                                  EDEPTH
C      ARGUMENTS A,B,XM,T AND X SAME AS FOR SUBROUTINE INTERS.          EDEPTH
C     ARGUMENTS XL AND XU, IF NONZERO, ARE FINAL RESULTS OF LAST CALL.  EDEPTH
C                                                                       EDEPTH
      IMPLICIT REAL*8 (A-H,O-Z)                                         EDEPTH
      DIMENSION A(3,3),B(3,3),XM(3),Y(3),XA(3),XB(3)                    EDEPTH
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           EDEPTH
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         EDEPTH
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      DIMENSION C1(3,4),C2(3,4),C3(3,4),XBM(3),PXBL(3),PXAU(3),AB(3,3)  EDEPTH
      DIMENSION AXA(3),BXBM(3),PXAL(3),PXBU(3)                          EDEPTH
      EQUIVALENCE (XBM(1),C1(1,4)), (PXBL(1),C2(1,4)), (PXAU(1),C3(1,4))EDEPTH
C                                                                       EDEPTH
C                                   INITIAL GUESSES                     EDEPTH
C                                   XA = Y/T                            EDEPTH
C                                   XB = M+(Y-M)/T                      EDEPTH
C                                   L = -!XB-XA!/!AXA!                  EDEPTH
C                                   U = -!XB-XA!/!B(XB-M)!              EDEPTH
C                                                                       EDEPTH
      D1 = 0.0                                                          EDEPTH
      D2 = 0.0                                                          EDEPTH
      DO  9 I=1,3                                                       EDEPTH
      XA(I) = Y(I)/T                                                    EDEPTH
      XBM(I) = (Y(I)-XM(I))/T                                           EDEPTH
      XB (I) = XBM(I)+XM(I)                                             EDEPTH
    9 D1 = D1+(XB(I)-XA(I))**2                                          EDEPTH
      IF (DABS(T-1.0).LE.EPS(6)) GO TO 31                               EDEPTH
      ITER = 0                                                          EDEPTH
      CALL MAT33 (A,B,AB)                                               EDEPTH
      IF  (XL.NE.0.0)  GO TO 11                                         EDEPTH
      IF  (XU.NE.0.0)  GO TO 11                                         EDEPTH
      D3 = 0.0                                                          EDEPTH
      DO 10 I=1,3                                                       EDEPTH
      AXA(I) = A(I,1)*XA(1)                                             EDEPTH
     *       + A(I,2)*XA(2)                                             EDEPTH
     *       + A(I,3)*XA(3)                                             EDEPTH
      D2 = D2 + AXA(I)**2                                               EDEPTH
      BXBM(I) = B(I,1)*XBM(1)                                           EDEPTH
     *        + B(I,2)*XBM(2)                                           EDEPTH
     *        + B(I,3)*XBM(3)                                           EDEPTH
   10 D3 = D3+BXBM(I)**2                                                EDEPTH
      XL = -DSQRT(D1/D2)                                                EDEPTH
      XU = -DSQRT(D1/D3)                                                EDEPTH
C                                                                       EDEPTH
C                                  START OF ITERATION                   EDEPTH
C                                                                       EDEPTH
   11 ITER = ITER+1                                                     EDEPTH
      IF (NPRT(17).NE.0) WRITE (6,12) ITER,XL,XU,XA,XB                  EDEPTH
```

```
   12 FORMAT(' EDEPTH ITER',I6,8G14.6)                                     EDEPTH
      IF (ITER.LE.50) GO TO 14                                             EDEPTH
      WRITE (6,13)                                                         EDEPTH
   13 FORMAT(' EDEPTH ITERATION DID NOT CONVERGE')                         EDEPTH
      GO TO 31                                                             EDEPTH
C                                                                          EDEPTH
C                                 FORM MATRICES                            EDEPTH
C                                 C1 = LUAB + LA + UB                      EDEPTH
C                                 C2 = C1                                  EDEPTH
C                                 C3 = C1'                                 EDEPTH
C                                                                          EDEPTH
   14 XLAU = XU*XL                                                         EDEPTH
      DO 22 I=1,3                                                          EDEPTH
      XBM(I) = 0.0                                                         EDEPTH
      DO 22 J=1,3                                                          EDEPTH
      C1(I,J) = XLAU*AB(I,J) + XL*A(I,J) + XU*B(I,J)                       EDEPTH
      C2(I,J) = C1(I,J)                                                    EDEPTH
      C3(J,I) = C1(I,J)                                                    EDEPTH
   22 XBM(I) = XBM(I) - XL*A(I,J)*XM(J)                                    EDEPTH
C                                                                          EDEPTH
C                                 SOLVE FOR (XB-M)                         EDEPTH
C                                 C1(XB-M) = -LAM                          EDEPTH
C                                                                          EDEPTH
      CALL DSMSOL(C1,3,3)                                                  EDEPTH
C                                                                          EDEPTH
C                                 EVALUATE                                 EDEPTH
C                                 XB = (XB-M)+M                            EDEPTH
C                                 B(XB-M)                                  EDEPTH
C                                 AXA                                      EDEPTH
C                                 C13 = (1-XA'AXA)/2                       EDEPTH
C                                 C23 = (1-(XB-M)'B(XB-M))/2               EDEPTH
C                                                                          EDEPTH
      C13 = 0.0                                                            EDEPTH
      C23 = 0.0                                                            EDEPTH
      DO 23 I=1,3                                                          EDEPTH
      XB(I) = XBM(I)+XM(I)                                                 EDEPTH
      BXBM(I) = B(I,1)*XBM(1)                                              EDEPTH
     *        + B(I,2)*XBM(2)                                              EDEPTH
     *        + B(I,3)*XBM(3)                                              EDEPTH
   23 XA(I) = XB(I) + XU*BXBM(I)                                           EDEPTH
      DO 24 I=1,3                                                          EDEPTH
      AXA(I) = A(I,1)*XA(1)                                                EDEPTH
     *       + A(I,2)*XA(2)                                                EDEPTH
     *       + A(I,3)*XA(3)                                                EDEPTH
      C13 = C13 + XA(I)*AXA(I)                                             EDEPTH
      C23 = C23 + XBM(I)*BXBM(I)                                           EDEPTH
   24 PXBL(I) = -AXA(I)                                                    EDEPTH
      C13 = (1.0-C13)/2.0                                                  EDEPTH
      C23 = (1.0-C23)/2.0                                                  EDEPTH
C                                 *         DXB                            EDEPTH
C                                 SOLVE FOR ---                            EDEPTH
C                                 *         DL                             EDEPTH
```

```
C                                                                       EDEPTH
C                                   * DXB                               EDEPTH
C                                   C2--- = -AXA                        EDEPTH
C                                   * DL                                EDEPTH
C                                                                       EDEPTH
      CALL DSMSOL(C2,3,3)                                               EDEPTH
C                                                                       EDEPTH
C                                   CALCULATE                           EDEPTH
C                                   DXA   DXB     DXB                   EDEPTH
C                                   --- = --- + UB---                   EDEPTH
C                                   DL    DL      DL                    EDEPTH
C                                                                       EDEPTH
C                                   *         DXA                       EDEPTH
C                                   C11 = XA'A---                       EDEPTH
C                                   *         DL                        EDEPTH
C                                                                       EDEPTH
C                                   *             DXB                   EDEPTH
C                                   C21 = (XB-M)'B---                   EDEPTH
C                                   *             DL                    EDEPTH
C                                                                       EDEPTH
      C11 = 0.0                                                         EDEPTH
      C21 = 0.0                                                         EDEPTH
      DO 25 I=1,3                                                       EDEPTH
      PXAL(I) = B(I,1)*PXBL(1)                                          EDEPTH
     *        + B(I,2)*PXBL(2)                                          EDEPTH
     *        + B(I,3)*PXBL(3)                                          EDEPTH
      PXAL(I) = PXBL(I) + XU*PXAL(I)                                    EDEPTH
      C11 = C11 + AXA(I)*PXAL(I)                                        EDEPTH
      C21 = C21 + BXBM(I)*PXBL(I)                                       EDEPTH
   25 PXAU(I) = -BXBM(I)                                                EDEPTH
C                                                                       EDEPTH
C                                   *         DXA                       EDEPTH
C                                   SOLVE FOR ---                       EDEPTH
C                                   *         DU                        EDEPTH
C                                                                       EDEPTH
C                                   * DXA                               EDEPTH
C                                   C3--- = -B(XB-M)                    EDEPTH
C                                   * DU                                EDEPTH
C                                                                       EDEPTH
      CALL DSMSOL(C3,3,3)                                               EDEPTH
C                                                                       EDEPTH
C                                   CALCULATE                           EDEPTH
C                                   DXB   DXA     DXA                   EDEPTH
C                                   --- = --- + LA---                   EDEPTH
C                                   DU    DU      DU                    EDEPTH
C                                                                       EDEPTH
C                                   *         DXA                       EDEPTH
C                                   C12 = XA'A---                       EDEPTH
C                                   *         DU                        EDEPTH
C                                                                       EDEPTH
C                                   *             DXB                   EDEPTH
C                                   C22 = (XB-M)'B---                   EDEPTH
```

```
C                                          *           DU                   EDEPTH
C                                                                           EDEPTH
      C12 = 0.0                                                             EDEPTH
      C22 = 0.0                                                             EDEPTH
      DO 26 I=1,3                                                           EDEPTH
      PXBU(I) = PXAU(I) + XL*(A(I,1)*PXAU(1)                                EDEPTH
     *     + A(I,2)*PXAU(2) + A(I,3)*PXAU(3) )                              EDEPTH
      C12 = C12 + AXA(I)*PXAU(I)                                            EDEPTH
   26 C22 = C22 + BXBM(I)*PXBU(I)                                           EDEPTH
C                                                                           EDEPTH
C                                 SOLVE FOR DL AND DU                       EDEPTH
C                                 C11*DL + C12*DU = C13                     EDEPTH
C                                 C21*DL + C22*DU = C23                     EDEPTH
C                                                                           EDEPTH
      DET = C11*C22-C12*C21                                                 EDEPTH
      DL = (C13*C22-C12*C23)/DET                                            EDEPTH
      DU = (C11*C23-C13*C21)/DET                                            EDEPTH
C                                                                           EDEPTH
C                                 INCREMENT L AND U                         EDEPTH
C                                 TEST FOR CONVERGENCE                      EDEPTH
C                                                                           EDEPTH
      XL = XL + DL                                                          EDEPTH
      XU = XU + DU                                                          EDEPTH
      IF (DABS(DL/XL).GT.EPS(12)) GO TO 11                                  EDEPTH
      IF (DABS(DU/XU).GT.EPS(12)) GO TO 11                                  EDEPTH
   31 CONTINUE                                                              EDEPTH
      RETURN                                                                EDEPTH
      END                                                                   EDEPTH
```

```
      DOUBLE PRECISION FUNCTION EFUNCT (TH,THD,SPR,JSTOP)                EFUNCT
C                                                   REV 20    04/29/80EFUNCT
C     COMPUTES NONLINEAR SRRING TORQUE FOR EULER JOINTS.                 EFUNCT
C                                                                        EFUNCT
C     ARGUMENTS:                                                         EFUNCT
C          TH    - THETA IS THE ANGLE OF THE EULER AXIS                  EFUNCT
C          THD   - THETA DOT                                             EFUNCT
C          SPR   - ARRAY OF 5 VALUES DESCRIBING FUNCTION EVALUATION      EFUNCT
C          JSTOP - INDICATOR TO BE SET TO ONE IF IN STOP                 EFUNCT
C                                                                        EFUNCT
      IMPLICIT REAL*8(A-H,O-Z)                                           EFUNCT
      DIMENSION SPR(5)                                                   EFUNCT
      JSTOP = 0                                                          EFUNCT
      EFUNCT = TH*SPR(1)                                                 EFUNCT
      TEN = 10.0                                                         EFUNCT
      Q = DSIGN(TEN*THD,TH*THD)                                          EFUNCT
      IF (Q.GT.1.0) Q = 1.0                                              EFUNCT
      IF (Q.LT.-1.0) Q = -1.0                                            EFUNCT
      X = 0.5*(1.0+SPR(4)+Q*(1.0-SPR(4)))                                EFUNCT
      IF (SPR(5).GT.0.0) GO TO 10                                        EFUNCT
      EFUNCT = X*EFUNCT                                                  EFUNCT
      GO TO 99                                                           EFUNCT
   10 IF (DABS(TH).LT.SPR(5)) GO TO 99                                   EFUNCT
      JSTOP = 1                                                          EFUNCT
      Z = DABS(TH) - SPR(5)                                              EFUNCT
      EFUNCT = EFUNCT + DSIGN(X*(SPR(2)+Z*SPR(3))*Z**2,TH)               EFUNCT
   99 RETURN                                                             EFUNCT
      END                                                                EFUNCT
```

```
      SUBROUTINE EJOINT(IJ,NK)                                          JDRIFT
C                                                  REV IV    07/24/86SLIP
C     COMPUTES THE TORQUES ACTING ON AN EULER JOINT                     EJOINT
C     AND ADDS THEM TO THE U2 ARRAY.                                    EJOINT
C                    .                                                  EJOINT
C     ARGUMENTS:                                                        EJOINT
C        NK = 0 - REGULAR COMPUTATION FOR ALL EULER JOINTS              JDRIFT
C           # 0 - COMPUTE ONLY FOR JOINT NJ IMPULSE                     EJOINT
C                                                                       EJOINT
C        IJ = 1 IMPULSE ON PRECESSION AXIS ONLY                         EJOINT
C           = 2 IMPULSE ON NUTATION AXIS ONLY                           EJOINT
C           = 3 IMPULSE ON SPIN AXIS ONLY                               EJOINT
C           = 4 IMPULSE ON GLOBALGRAPHIC AXIS                           EJOINT
C        NK = 0, IJ # 0, SPECIAL COMPUTATIONS OF HIR AND HB ONLY        JDRIFT
C                                                                       EJOINT
      IMPLICIT REAL*8(A-H,O-Z)                                          EJOINT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           EJOINT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),EJOINT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       EJOINT
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPH1(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     EJOINT
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    EJOINT
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),EJOINT
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         EJOINT
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           EJOINT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         EJOINT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TEMPVS/ DH1(3,3),DH4(3,3),TH(3,3),HIM(3,3),HIJ(3,3),       EJOINT
     *               HDT(3,3),H2(3,3),SH(3),TM(3),TJ(3),WMJ(3),AD(3),   EJOINT
     *               CV(3),CS(3),ANGL(3),HD3(3),CC(3),T9(3),LSKIP(3)    EJOINT
     *              ,IDMMY,DMMY(35015)                                  80386
      LOGICAL LSKIP                                                     EJOINT
      IF (NJNT.LE.0) GO TO 99                                           EJOINT
      CALL ELTIME(1,31)                                                 EJOINT
      J1 = 1                                                            EJOINT
      J2 = NJNT                                                         EJOINT
      NJ = NK                                                           JDRIFT
      IF (NJ.EQ.0) GO TO 11                                             EJOINT
      J1 = NJ                                                           EJOINT
      J2 = NJ                                                           EJOINT
      IF(IJ.LT.0) NJ = 0                                                JDRIFT
   11 DO 98 J=J1,J2                                                     EJOINT
      IF (IABS(IPIN(J)).NE.4) GO TO 98                                  EJOINT
      M = IABS(JNT(J))                                                  EJOINT
      CALL DOT33(D(1.1,M),HT(1,1,2*J-1),DH1)                            EJOINT
      CALL DOT33(D(.,1,J+1),HT(1,1,2*J),DH4)                            EJOINT
      CALL DOT33(DH4,DH1,TH)                                            EJOINT
```

```
      DO 12 I=1,3                                              EJOINT
   12 ANG(I,J) = ANG(I,J) + CONST(I,J)                         EJOINT
      IC = IEULER(J)                                           EJOINT
      CALL EULRAD (TH,ANG(1,J),IC)                             EJOINT
      CALL ROT(H2,3,-ANG(1,J))                                 EJOINT
      DO 13 I=1,3                                              EJOINT
      ANG(I,J) = ANG(I,J) - CONST(I,J)                         EJOINT
      HIR(I,1,J) = DH1(I,3)                                    EJOINT
      HIR(I,3,J) = DH4(I,3)                                    EJOINT
      HIM(I,1) = HT(I,3,2*J-1)                                 EJOINT
      HIJ(I,3) = HT(I,3,2*J)                                   EJOINT
      LSKIP(I) = .FALSE.                                       EJOINT
      FE(I,J) = 0.0                                            EJOINT
      CV(I)   = 0.0                                            EJOINT
      CS(I)   = 0.0                                            EJOINT
      V2(I,J) = 0.0                                            EJOINT
      TQE(I,J) = 0.0                                           EJOINT
   13 TQ(I,J) = 0.0                                            EJOINT
      WJ(J)   = 0.0                                            EJOINT
      TQC = 0.0                                                EJOINT
      IF (IJ.EQ.4) GO TO 55                                    EJOINT
      CALL MAT31 (HT(1,1,2*J-1),H2(1,1),HIM(1,2))              EJOINT
      CALL MAT31 (HT(1,1,2*J-1),H2(1,2),HIM(1,3))              EJOINT
      CALL DOT31 (D(1,1,M),HIM(1,2),H2(1,2))                   EJOINT
      CALL DOT31 (D(1,1,M),HIM(1,3),H2(1,3))                   EJOINT
      CALL CROSS (H2(1,2),HIR(1,3,J),H2(1,1))                  EJOINT
      CALL DOT31 (D(1,1,M  ),WMEG(1,M  ),TM)                   EJOINT
      CALL DOT31 (D(1,1,J+1),WMEG(1,J+1),TJ)                   EJOINT
      SWJ = 0.0                                                EJOINT
      DO 14 I=1,3                                              EJOINT
      HIR(I,2,J) = H2(I,2)                                     EJOINT
      WMJ(I) = TJ(I) - TM(I)                                   EJOINT
   14 SWJ = SWJ + WMJ(I)**2                                    EJOINT
      WJ(J) = DSQRT(SWJ)                                       EJOINT
      CALL DOT31 (HIR(1,1,J),WMJ,AD)                           EJOINT
      CALL CROSS (TM,HIR(1,1,J),HDT(1,1))                      EJOINT
      CALL CROSS (TM,HIR(1,2,J),HDT(1,2))                      EJOINT
      CALL CROSS (TJ,HIR(1,3,J),HDT(1,3))                      EJOINT
      CALL MAT31 (D(1,1,J+1),HIR(1,1,J),HIJ(1,1))              EJOINT
      CALL MAT31 (D(1,1,J+1),HIR(1,2,J),HIJ(1,2))              EJOINT
      CALL MAT31 (D(1,1,M  ),HIR(1,3,J),HIM(1,3))              EJOINT
      N = IEULER(J)                                            EJOINT
      DO 15 I=1,3                                              EJOINT
      SH(I) = AD(I)                                            JDRIFT
      DO 15 K=1,3                                              JDRIFT
      HIR(I,K,2*J+29) = HIM(I,K)                               JDRIFT
   15 HIR(I,K,2*J+30) = HIJ(I,K)                               JDRIFT
      IF (N.EQ.8) GO TO 19                                     EJOINT
      IF (N.GT.3) GO TO 16                                     EJOINT
      SH(N) = 0.0                                              EJOINT
      GO TO 18                                                 EJOINT
   16 DO 17 I=1,3                                              EJOINT
```

```
17 IF (I.NE.N-3) SH(I) = 0.0                                        EJOINT
18 IF (N.NE.2) GO TO 21                                             EJOINT
19 HX = H2(1,1)*HIR(1,1,J) + H2(2,1)*HIR(2,1,J) + H2(3,1)*HIR(3,1,J) EJOINT
   IF (DABS(HX).GE.EPS(6)) GO TO 20                                 EJOINT
   SH(1) = ANGD(1,J)                                                EJOINT
   SH(3) = ANGD(3,J)                                                EJOINT
   GO TO 21                                                         EJOINT
20 CALL DOT31 (H2,WMJ,SH)                                           EJOINT
   SH(1) = SH(1)/HX                                                 EJOINT
   IF  (N.EQ.2)  SH(2) = 0.0                                        EJOINT
   SH(3) = SH(3)/HX                                                 EJOINT
21 DO 22 I=1,3                                                      EJOINT
   ANGD(I,J) = SH(I)                                                EJOINT
22 HDT(I,2) = HDT(I,2) + SH(1)*H2(I,3)                              EJOINT
   IF (NJ.NE.0) N = IJ+3                                            EJOINT
   IF (N.GT.3) GO TO 30                                             EJOINT
   N4 = 4-N                                                         EJOINT
   IF (N.EQ.2) AHDT = HDT(1,2)*WMJ(1)+HDT(2,2)*WMJ(2)+HDT(3,2)*WMJ(3)EJOINT
   IF (N.NE.2) AHDT = -(SH(2)*HDT(1,2)+SH(N4)*HDT(1,N4))*H2(1,N)    EJOINT
  *                   -(SH(2)*HDT(2,2)+SH(N4)*HDT(2,N4))*H2(2,N)    EJOINT
  *                   -(SH(2)*HDT(3,2)+SH(N4)*HDT(3,N4))*H2(3,N)    EJOINT
   CALL MAT31 (D(1,1,M  ),H2(1,N),HB(1,2*J-1))                      EJOINT
   CALL MAT31 (D(1,1,J+1),H2(1,N),HB(1,2*J  ))                      EJOINT
   DO 25 I=1,3                                                      EJOINT
   V2(I,J) = AHDT*H2(I,N)                                           EJOINT
25 IF (N.EQ.I) LSKIP(I) = .TRUE.                                    EJOINT
   GO TO 42                                                         EJOINT
30 IF (N.GT.6) GO TO 40                                             EJOINT
   K3J = 3*J-2                                                      EJOINT
   DO 32 I=1,3                                                      EJOINT
   IF (NJ.EQ.0) GO TO 31                                            EJOINT
   IF  (I.EQ.N-3)  CREST = VISC(7,K3J)                              EJOINT
   TQE(I,J) = H2(I,N-3)                                             EJOINT
   GO TO 32                                                         EJOINT
31 V2(I,J) = -HDT(I,N-3)*AD(N-3)                                    EJOINT
   HB(I,2*J-1) = HIM(I,N-3)                                         EJOINT
   HB(I,2*J  ) = HIJ(I,N-3)                                         EJOINT
   IF (I.NE.N-3) LSKIP(I) = .TRUE.                                  EJOINT
32 K3J = K3J + 1                                                    EJOINT
   IF  (NJ)  35,42,35                                               EJOINT
40 IF (N.EQ.7) GO TO 97                                             EJOINT
42 IF(IJ.NE.0) GOTO 98                                              JDRIFT
   DO 41 I=1,3                                                      JDRIFT
   IF  (LSKIP(I))  GO TO 41                                         EJOINT
   K3J = 3*J-3+I                                                    EJOINT
   CV(I) = ANGD(I,J)*VISCOS(DABS(ANGD(I,J)),VISC(1,K3J),HA(I,2*J))  EJOINT
   CS(I) = EFUNCT(ANG(I,J),ANGD(I,J),SPRING(1,K3J),JSTOP(I,1,J))    EJOINT
   FE(I,J) = CS(1) + CV(I) + HA(I,2*J)*HA(I,2*J-1)                  EJOINT
41 CONTINUE                                                         EJOINT
   CALL MAT31(HIR(1,1,J),FE(1,J),TQE(1,J))                          EJOINT
   IF(NJ.GT.0) GO TO 34                                             EJOINT
55 IF (IGLOB(J).EQ.0) GO TO 34                                      EJOINT
```

```
      HD3(1) = TH(3,1)                                                   EJOINT
      HD3(2) = TH(3,2)                                                   EJOINT
      HD3(3) = TH(3,3)                                                   EJOINT
      CALL GLOBAL (J,HD3,DH1,TQC,T9,ANGL)                                EJOINT
   34 CONTINUE                                                           EJOINT
C                                                                        EJOINT
C     ADD TORQUE CONVERTED TO LOCAL REFERENCE TO U2 ARRAY BY             EJOINT
C      U2(M  ) = U2(M  ) + D(M  )*TQ                                     EJOINT
C      U2(J+1) = U2(J+1) - D(J+1)*TQ                                     EJOINT
C                                                                        EJOINT
   35 DO  51  I=1,3                                                      EJOINT
      TQ(I,J) = TQE(I,J)+TQC*T9(I)                                       EJOINT
      TTI(I) = TQ(I,J)                                                   EJOINT
      DO 51 K=1,3                                                        EJOINT
      U2(K,M  ) = U2(K,M  ) + D(K,I,M  )*TQ(I,J)                         EJOINT
   51 U2(K,J+1) = U2(K,J+1) - D(K,I,J+1)*TQ(I,J)                         EJOINT
C                                                                        EJOINT
C     STORE DATA INTO PRJNT ARRAY FOR OUTPUT ROUTINE                     EJOINT
C                                                                        EJOINT
   97 PRJNT(1,J) = IEULER(J)                                             EJOINT
      PRJNT(2,J) = ANG(1,J)                                              EJOINT
      PRJNT(3,J) = ANG(2,J)                                              EJOINT
      PRJNT(4,J) = ANG(3,J)                                              EJOINT
      PRJNT(5,J)=CS(1)**2+CS(3)**2+2.0*CS(1)*CS(3)*TH(3,3)+CS(2)**2      JTF785
      PRJNT(6,J)=CV(1)**2+CV(3)**2+2.0*CV(1)*CV(3)*TH(3,3)+CV(2)**2      JTF785
      PRJNT(7,J) = TQ(1,J)**2 + TQ(2,J)**2 + TQ(3,J)**2                  EJOINT
   98 CONTINUE                                                           EJOINT
      CALL ELTIME(2,31)                                                  EJOINT
   99 RETURN                                                             EJOINT
      END                                                                EJOINT
```

```
      DOUBLE PRECISION FUNCTION ELONG(A,B,C,D,E)                          ELONG
C                                                   REV 01    10/05/72ELONG
C     COMPUTES ARC LENGTH OF ELLIPSE      AX**2 + 2BXY + CY**2 - 1       ELONG
C     FROM THETA-0 (POSITIVE X AXIS) TO THETA-E (RADIANS)                 ELONG
C     WHERE D IS NOMINAL INCREMENT OF INTEGRATION.                        ELONG
C                                                                         ELONG
      IMPLICIT REAL*8(A-H,O-Z)                                            ELONG
      N=DABS(E/D)                                                         ELONG
      N=N+N                                                               ELONG
      IF(N.EQ.0)N=2                                                       ELONG
      Z=N                                                                 ELONG
      T=E/Z                                                               ELONG
      F = DSQRT ((1.+(B/A)**2)/A)                                         ELONG
      CS=1.                                                               ELONG
      SN=0.                                                               ELONG
      DCS=DCOS(T)                                                         ELONG
      DSN=DSIN(T)                                                         ELONG
      S=F/2.                                                              ELONG
      AC = A+C                                                            ELONG
      BAC = B*B-A*C                                                       ELONG
      DO 10 I=1,N,2                                                       ELONG
      CSS=CS*DCS-SN*DSN                                                   ELONG
      SN=SN*DCS+CS*DSN                                                    ELONG
      CS=CSS                                                              ELONG
      G=(A*CS+B*SN)*CS+(B*CS+C*SN)*SN                                     ELONG
      G = G**2/(AC + BAC/G)                                               ELONG
      F=(F+1./(F*G))/2.                                                   ELONG
      S=S+F+F                                                             ELONG
      CSS=CS*DCS-SN*DSN                                                   ELONG
      SN=SN*DCS+CS*DSN                                                    ELONG
      CS=CSS                                                              ELONG
      G=(A*CS+B*SN)*CS+(B*CS+C*SN)*SN                                     ELONG
      G = G**2/(AC + BAC/G)                                               ELONG
      F=(F+1./(F*G))/2.                                                   ELONG
      S=S+F                                                               ELONG
   10 CONTINUE                                                            ELONG
      ELONG=(S+S-F)*T/3.                                                  ELONG
      RETURN                                                              ELONG
      END                                                                 ELONG
```

```
      SUBROUTINE ELTIME(L,N)                                            ELTIME
C                                                  REV III.2 08/08/84REVIII
C     COUNTS THE NUMBER OF TIMES CERTAIN BASIC SUBROUTINES ARE CALLED   ELTIME
C     AND ACCOUNTS FOR ALL COMPUTER CPU TIME USED BY THESE ROUTINES.    ELTIME
C                                                                       ELTIME
C       ARGUMENTS L: 1 INDICATES CALL IS AT START OF ROUTINE            ELTIME
C                    2 INDICATES CALL IS AT END OF ROUTINE.             ELTIME
C                   >2 PAGE NUMBER FOR CALL AT END OF RUN               PAGE
C                 N: THE SUBROUTINE IDENTIFICATION NUMBER.              ELTIME
C                                                                       ELTIME
C       ASSUMES FUNCTION LTIME(1) IS GIVING ELAPSED CPU TIME IN INTEGER ELTIME
C       UNITS OF 0.01 SECONDS SINCE FUNCTION LTIME(0) WAS CALLED.       ELTIME
C                                                                       ELTIME
      DIMENSION NT(40),MTIN(40),NC(40),IND(40)                          ELTIME
      REAL*8 SUB(40)                                                    ELTIME
      DATA   SUB/                                                       ELTIME
     *   8H MAIN3D ,8H INPUT  ,8H DINT   ,8H PRIPLT ,8H DZP    ,        ELTIME
     *   8H PDAUX  ,8H UPDATE ,8H OUTPUT ,8H DAUX   ,8H SETUP1 ,        ELTIME
     *   8H CHAIN  ,8H CONTCT ,8H VISPR  ,8H DAUX11 ,8H DAUX12 ,        ELTIME
     *   8H DAUX22 ,8H DAUX31 ,8H DAUX32 ,8H DAUX33 ,8H FSMSOL ,        ELTIME
     *   8H PLELP  ,8H BELTRT ,8H SEGSEG ,8H AIRBAG ,8H RSTART ,        ELTIME
     *   8H SETUP2 ,8H IMPULS ,3H IMPLS2 ,8H AIRBG3 ,8H DAUX55 ,        ELTIME
     *   8H EJOINT ,8H SPDAMP ,8H DAUX44 ,8H FLXSEG ,8H EQUILB ,        ELTIME
     *   8H POSTPR ,8H WINDY  ,8H HBELT  ,8H HPTURB ,8H        /        ELTIME
      IF (N.GT.1) GO TO 20                                              ELTIME
      IF (L.GT.1) GO TO 40                                              ELTIME
C                                                                       ELTIME
C     INITIAL CALL AT BEGINNING OF MAIN PROGRAM.                        ELTIME
C                                                                       ELTIME
C     MTIN(1) = LTIME(0)                                                80386
      DO 11 I=1,40                                                      ELTIME
      IND(I)  =  0                                                      ELTIME
      NC(I)   =  0                                                      ELTIME
      MTIN(I) = -1                                                      ELTIME
   11 NT(I)   =  0                                                      ELTIME
      NSUB    =  1                                                      ELTIME
      IND(1)  =  1                                                      ELTIME
      NC(1)   =  1                                                      ELTIME
      MTIN(1) =  0                                                      ELTIME
      CALL TIMER(ISTART)                                                80386
      GO TO 99                                                          ELTIME
C                                                                       ELTIME
C      CALL AT BEGINNING OF NTH SUBROUTINE.                             ELTIME
C                                                                       ELTIME
   20 IF (L.GT.1) GO TO 30                                              ELTIME
      CALL TIMER(INOW)                                                  80386
      MTIN(N) = INOW-ISTART                                             80386
      IF (NC(N).NE.0) GO TO 21                                          ELTIME
      NSUB = NSUB+1                                                     ELTIME
      IND(NSUB) = N                                                     ELTIME
   21 NC(N) = NC(N)+1                                                   ELTIME
      GO TO 99                                                          ELTIME
```

```
C                                                                       ELTIME
C     CALL AT END OF NTH SUBROUTINE.                                    ELTIME
C                                                                       ELTIME
   30 CALL TIMER(INOW)                                                  80386
      MTOUT = INOW-ISTART                                               80386
      NDIFF = MTOUT-MTIN(N)                                             ELTIME
      MTIN(N) = -1                                                      ELTIME
      IF (NDIFF.EQ.0) GO TO 99                                          80386
      NT(N) = NT(N) + NDIFF                                             ELTIME
      DO 31 I=1,40                                                      ELTIME
      IF (MTIN(I).NE.-1) MTIN(I) = MTIN(I) + NDIFF                      ELTIME
   31 CONTINUE                                                          ELTIME
      GO TO 99                                                          80386
C                                                                       ELTIME
C     SUBSEQUENT CALLS FROM MAIN PROGRAM, PRINT SUMMARY TABLE.          ELTIME
C                                                                       ELTIME
   40 CALL TIMER(INOW)                                                  80386
      NTSUM = INOW-ISTART                                               80386
      NT(1) = NTSUM - MTIN(1)                                           ELTIME
      TIME = FLOAT(NTSUM)/100.0                                         ELTIME
      WRITE (6,41) TIME,L                                               PAGE
   41 FORMAT('1 ELAPSED CPU TIME =',F10.2,' SECONDS',85X,'PAGE',I5//    PAGE
     *  '     SUB          CALLS        TIME          %      '//)       ELTIME
      PCSUM = 0.0                                                       ELTIME
      NTSUM = 0                                                         ELTIME
      DO 42 I=1,NSUB                                                    ELTIME
      J = IND(I)                                                        ELTIME
      PC = FLOAT(NT(J))/TIME                                            ELTIME
      PCSUM = PCSUM + PC                                                ELTIME
      NTSUM = NTSUM + NT(J)                                             ELTIME
   42 WRITE (6,43) SUB(J),NC(J),NT(J),PC                                ELTIME
   43 FORMAT(A10,2I10,F10.2)                                            ELTIME
      WRITE (6,44) NTSUM,PCSUM                                          ELTIME
   44 FORMAT('0TOTAL',14X,I10,F10.2)                                    ELTIME
   99 RETURN                                                            ELTIME
      END                                                               ELTIME
```

```
      SUBROUTINE EQUILB (YPR,IYPR)                                      EQUILB
C                                                REV IV    02/01/88MISDOT
C                                                                       EQUILB
C     ADJUSTS INITIAL INPUT POSITION PARAMETERS SUPPLIED ON CARDS G.2   EQUILB
C     AND G.3 SUCH THAT INITIAL NORMAL CONTACT FORCES ARE EQUAL TO      EQUILB
C     EITHER SUPPLIED VALUES OR THOSE COMPUTED BY CONSTRAINT FORCES.    EQUILB
C                                                                       EQUILB
      IMPLICIT REAL*8(A-H,O-Z)                                          EQUILB
      DIMENSION  YPR(3,30) , IYPR(4,30)                                 EQUILB
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           EQUILB
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),EQUILB
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       EQUILB
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     EQUILB
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    EQUILB
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),EQUILB
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   EQUILB
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),EQUILB
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              EQUILB
     *               KQ1(12),KQ2(12),KQTYPE(12)                         EQUILB
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), EQUILB
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), EQUILB
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               EQUILB
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         EQUILB
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           EQUILB
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       EQUILB
     *               JOINT(30),CGS(30),JS(30)                           EQUILB
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         EDGE
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         EDGE
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      EQUILB
      LOGICAL*1 CGS,JS                                                  EQUILB
      COMMON/TEMPVS/ DMNT(3,3),XMN(3),XMM(3),TM(3),RM(3),DMMY(35092)    80386
      DIMENSION  TEMP(3),T(5),FX(10),FX1(10)                            EDGE
      DIMENSION  X(10),GX(10),DX(10),DXP(10),DPN(5,10)                  EQUILB
      DIMENSION  JPL(10),JSG(10),JX(10),M1(10),M2(10),M3(10),MT(10)     EQUILB
      DIMENSION  NTV(10),NI1(10),NSG(10),NAV(10),KSG(5,10)              EQUILB
      DIMENSION  ISG(5),IPL(5),LTYPE(5),INDGX(5),NTNQ(5)                EQUILB
      DIMENSION  SX(10),SGX(10),XDEV(10),WORD(2)                        EQUILB
      DATA       BLANK/'       '/ , WORD/' SEGLP' , '   YPR'/           EQUILB
      CALL ELTIME (1,35)                                                EQUILB
C                                                                       EQUILB
C     INPUT CARDS G.4, G.5.A-G.5.N, AND G.6.A-G.6.M                     EQUILB
C                                                                       EQUILB
      READ   (5,60)  NVAR,NCON                                          EQUILB
      WRITE  (6,51)  NVAR,NCON,NPG                                      PAGE
      NPG=NPG+1                                                         PAGE
   51 FORMAT('1',5X,'NVAR =',I3,3X,'NCON =',I3,96X,                     PAGE
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     *        'PAGE',I5/120X,'CARD  G.4'/)                                       PAGE
      ICARD = 4                                                                  EQUILB
      JCARD = 0                                                                  EQUILB
      IF  (NVAR.LT.1 .OR. NVAR.GT.10)  GO TO 65                                  EQUILB
      IF  (NCON.LT.0 .OR. NCON.GT.5 )  GO TO 65                                  EQUILB
      WRITE  (6,52)                                                              EQUILB
   52 FORMAT('0',4X,'J',4X,'NTV',3X,'NI1',3X,'NSG',8X,'GX',12X,'XDEV',           EQUILB
     *7X,'JPL',3X,'JSG',3X,'NAV',3X,'KSG(I,J),I=1,NAV',28X,'CARDS G.5'/)EQUILB
      ICARD = 5                                                                  EQUILB
      DO  58  J=1,NVAR                                                           EQUILB
      JCARD = J                                                                  EQUILB
      READ   (5,53)     NTV(J),NI1(J),NSG(J),GX(J),XDEV(J),                      EQUILB
     *                JPL(J),JSG(J),IAV,(KSG(I,J),I=1,IAV)                       EQUILB
   53 FORMAT(3I4,2F8.0,8I4)                                                      EQUILB
      NAV(J) = IAV                                                               EQUILB
      WRITE  (6,54)  J,NTV(J),NI1(J),NSG(J),GX(J),XDEV(J),                       EQUILB
     *                JPL(J),JSG(J),IAV,(KSG(I,J),I=1,IAV)                       EQUILB
   54 FORMAT(4I6,2F15.6,8I6)                                                     EQUILB
      IF  (NTV(J).LT.1 .OR. NTV(J).GT.2    )  GO TO 65                           EQUILB
      IF  (NI1(J).LT.1 .OR. NI1(J).GT.3    )  GO TO 65                           EQUILB
      IF  (NSG(J).LT.1 .OR. NSG(J).GT.NSEG)  GO TO 65                            EQUILB
      IF  (NAV(J).LT.0 .OR. NAV(J).GT.5    )  GO TO 65                           EQUILB
      IF  (JPL(J).LT.1 .OR. JPL(J).GT.NPL )  GO TO 65                            EQUILB
      IF  (JSG(J).LT.1 .OR. JSG(J).GT.NSEG)  GO TO 65                            EQUILB
      K = JPL(J)                                                                 EQUILB
      NNPL = MNPL(K)                                                             EQUILB
      IF  (NNPL.LT.1 .OR. NNPL.GT.5)  GO TO 65                                   EQUILB
      DO  55  I=1,NNPL                                                           EQUILB
      IF  (JSG(J).NE.MPL(2,I,K))  GO TO 55                                       EQUILB
      JSG(J) = I                                                                 EQUILB
      GO TO 56                                                                   EQUILB
   55 CONTINUE                                                                   EQUILB
      GO TO 65                                                                   EQUILB
   56 IF  (NAV(J).LE.0)  GO TO 58                                                EQUILB
      DO  57  I=1,IAV                                                            EQUILB
      IF  (KSG(I,J).LT.1 .OR. KSG(I,J).GT.NSEG)  GO TO 65                        EQUILB
   57 CONTINUE                                                                   EQUILB
   58 CONTINUE                                                                   EQUILB
      IF  (NCON.LE.0)  GO TO 17                                                  EQUILB
      WRITE  (6,59)                                                              EQUILB
   59 FORMAT('0',4X,'I',4X,'IPL',3X,'ISG',2X,'LTYPE',2X,'INDGX',                 EQUILB
     *        87X,'CARDS G.6'/)                                                  EQUILB
      ICARD = 6                                                                  EQUILB
      DO  64  I=1,NCON                                                           EQUILB
      JCARD = I                                                                  EQUILB
      READ   (5,60)     IPL(I),ISG(I),LTYPE(I),INDGX(I)                          EQUILB
      WRITE  (6,61)  I,IPL(I),ISG(I),LTYPE(I),INDGX(I)                           EQUILB
   60 FORMAT(4I4)                                                                EQUILB
   61 FORMAT(5I6)                                                                EQUILB
      IF  (  IPL(I).LT.1 .OR.   IPL(I).GT.NPL )  GO TO 65                        EQUILB
      IF  (  ISG(I).LT.1 .OR.   ISG(I).GT.NSEG)  GO TO 65                        EQUILB
      IF  (LTYPE(I).LT.3 .OR. LTYPE(I).GT.4   )  GO TO 65                        EQUILB
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      IF  (INDGX(I).LT.0 .OR. INDGX(I).GT.NVAR)  GO TO 65                EQUILB
      J = IPL(I)                                                         EQUILB
      NNPL = MNPL(J)                                                     EQUILB
      IF  (NNPL.LT.1 .OR. NNPL.GT.5)  GO TO 65                           EQUILB
      DO  62  K=1,NNPL                                                   EQUILB
      IF  (ISG(I).NE.MPL(2,K,J))  GO TO 62                               EQUILB
      ISG(I) = K                                                         EQUILB
      GO TO 63                                                           EQUILB
   62 CONTINUE                                                           EQUILB
      GO TO 65                                                           EQUILB
   63 IF  (INDGX(I).LE.0)  GO TO 64                                      EQUILB
      K = INDGX(I)                                                       EQUILB
      IF  (IPL(I).NE.JPL(K) .OR. ISG(I).NE.JSG(K))  GO TO 65             EQUILB
   64 CONTINUE                                                           EQUILB
      GO TO 17                                                           EQUILB
C                                                                        EQUILB
C     INPUT ERROR - PRINT MESSAGE AND TERMINATE PROGRAM.                 EQUILB
C                                                                        EQUILB
   65 WRITE  (6,66)  ICARD,JCARD                                         EQUILB
   66 FORMAT('0  INPUT ERROR ON CARD G.',I2,'.',I2,                      EQUILB
     *       '.  PROGRAM TERMINATED.')                                   EQUILB
      STOP 26                                                            EQUILB
C                                                                        EQUILB
C     DATA INITIALIZATION.                                               EQUILB
C                                                                        EQUILB
   17 NQORG = NQ                                                         EQUILB
      DO  19  K=1,NVAR                                                   EQUILB
      J = JPL(K)                                                         EQUILB
      I = JSG(K)                                                         EQUILB
      M1(K) = MPL(1,I,J)                                                 EQUILB
      M2(K) = MPL(2,I,J)                                                 EQUILB
      M3(K) = MPL(3,I,J)                                                 EQUILB
      MT(K) = NTPL (I,J)                                                 EQUILB
      JX(K) = 1                                                          EQUILB
      DXP(K) = 0.0                                                       EQUILB
      I1 = NI1(K)                                                        EQUILB
      I2 = NSG(K)                                                        EQUILB
      IF  (NTV(K).EQ.1)  X(K) = SEGLP(I1,I2)                             EQUILB
      IF  (NTV(K).EQ.2)  X(K) =   YPR(I1,I2)                             EQUILB
      SX (K) =   X(K)                                                    EQUILB
      SGX(K) =  GX(K)                                                    EQUILB
      IF  (NAV(K).LE.0)  GO TO 19                                        EQUILB
      IAV = NAV(K)                                                       EQUILB
      DO  18  L=1,IAV                                                    EQUILB
      J2 = KSG(L,K)                                                      EQUILB
      IF  (NTV(K).EQ.1)  DPN(L,K) = SEGLP(I1,I2) - SEGLP(I1,J2)          EQUILB
   18 IF  (NTV(K).EQ.2)  DPN(L,K) =   YPR(I1,I2) -   YPR(I1,J2)          EQUILB
   19 CONTINUE                                                           EQUILB
      IF  (NPRT(27).EQ.0)  GO TO 20                                      EQUILB
C                                                                        EQUILB
C     LET'S SEE WHAT USER INPUT LOOKS LIKE.                              EQUILB
C                                                                        EQUILB
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      CALL OUTPUT(0)                                                    EQUILB
      CALL DAUX(0)                                                      EQUILB
      CALL PRINT(6H USER )                                              EQUILB
      CALL OUTPUT(1)                                                    EQUILB
C                                                                       EQUILB
C     START FDF FORCE -> CONSTRAINT FORCE ITERATION                     EQUILB
C                                                                       EQUILB
   20 PENDOT = 0.0                                                      EQUILB
      DO  50  JITTER=1,10                                               EQUILB
C                                                                       EQUILB
C     ITERATE INPUT (X) SUCH THAT F(X) = G(X)                           EQUILB
C                                                                       EQUILB
      MVAR = 2                                                          EQUILB
      IF  (NVAR.EQ.1)  MVAR = 1                                         EQUILB
      DO  32  M=1,2                                                     EQUILB
      DO  32  I=MVAR,NVAR                                               EQUILB
      DO  32  J=1,I                                                     EQUILB
      NITER = 10                                                        EQUILB
      IF  (DXP(J).EQ.0.0)  NITER = 50                                   EQUILB
      DX(J) = 0.25                                                      EQUILB
      N1 = M1(J)                                                        EQUILB
      N2 = M2(J)                                                        EQUILB
      N3 = M3(J)                                                        EQUILB
      NP = JPL(J)                                                       EQUILB
      NT = MT(J)                                                        EQUILB
      I1 = NI1(J)                                                       EQUILB
      I2 = NSG(J)                                                       EQUILB
      IAV = NAV(J)                                                      EQUILB
      IF  (NTV(J).NE.2)  GO TO 15                                       EQUILB
      CALL DRCIJK (D,YPR,IYPR,HT,I2)                                    EQUILB
      IF  (NAV(J).LE.0)  GO TO 15                                       EQUILB
      DO  14  K=1,IAV                                                   EQUILB
      J2 = KSG(K,J)                                                     EQUILB
   14 CALL DRCIJK (D,YPR,IYPR,HT,J2)                                    EQUILB
   15 DO  29  ITER=1,NITER                                              EQUILB
      CALL CHAIN(0)                                                     JDRIFT
      PEN1 = PEN                                                        EQUILB
      NPSF = 1                                                          EDGE
      CALL PLELP(N2,N3,N1,NP,NT)                                        MISDOT
      PEN = PSF(1,1)                                                    EDGE
      FX1(J) = FX(J)                                                    EQUILB
      FXJ = 0.0                                                         EQUILB
      IF (PEN.GT.0.0) FXJ = PSF(2,1)                                    EDGE
      IF  (PEN.GT.0.0)  CALL FRCDFL (PEN,PENDOT,NT,1,FXJ,ELOSS)         EQUILB
      FX(J) = FXJ                                                       EQUILB
      IF  (JX(J)-2)  23,21,25                                           EQUILB
   21 IF  (FX(J)*FX1(J).GT.0.0)  GO TO 22                               EQUILB
      IF  (FX1(J).EQ.0.0)  JX(J) = 1                                    EQUILB
      FX(J) = FX1(J)                                                    EQUILB
      PEN = PEN1                                                        EQUILB
      DX(J) = 0.5*DX(J)                                                 EQUILB
      X(J)  = X(J) - DX(J)                                              EQUILB
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      GO TO 27                                                          EQUILB
   22 F2 = FX(J) - GX(J)                                                EQUILB
      F1 = FX1(J) - GX(J)                                               EQUILB
      IF  (F1*F2.LE.0.0)  GO TO 24                                      EQUILB
      IF  (DABS(F2).LT.DABS(F1)) GO TO 23                               EQUILB
   26 FX(J) = FX1(J)                                                    EQUILB
      DX(J) = -DX(J)                                                    EQUILB
      PEN = PEN1                                                        EQUILB
      X(J) = X(J) + 2.0*DX(J)                                           EQUILB
      GO TO 27                                                          EQUILB
   23 JX(J) = 1                                                         EQUILB
      IF  (PEN.GT.0.0)  JX(J) = 2                                       EQUILB
      IF  (ITER.GT.1 .AND. PEN.LT.0.0 .AND. PEN.LT.PEN1)  GO TO 26      EQUILB
      X(J) = X(J) + DX(J)                                               EQUILB
      GO TO 27                                                          EQUILB
   24 DXP(J) = DX(J)/(FX(J)-FX1(J))                                     EQUILB
      JX(J) = 3                                                         EQUILB
   25 IF  (DABS(FX(J)-GX(J)).LT.EPS(6))  GO TO 30                       EQUILB
      IF  (PEN.LT.0.0)  CALL FRCDFL (-PEN,PENDOT,NT,1,FXJ,ELOSS)        EQUILB
      IF  (PEN.LT.0.0)  FX(J) = -FXJ                                    EQUILB
      X(J) = X(J) - DXP(J)*(FX(J)-GX(J))                                EQUILB
   27 IF  (XDEV(J).LE.0.0)  GO TO 42                                    EQUILB
      IF  (DABS(X(J)-SX(J)).LE.XDEV(J))  GO TO 42                       EQUILB
      WRITE  (6,41)  J,X(J),SX(J),XDEV(J)                               EQUILB
   41 FORMAT('0 PROGRAM IS BEING TERMINATED IN SUBROUTINE EQUILB.'//    EQUILB
     *       '  ITERATION FOR VARIABLE NO.',I3,' IS NOT CONVERGING.'//  EQUILB
     *       '  VALUE OF X IS OUT OF RANGE. VALUES OF X,SX,XDEV ARE'//  EQUILB
     *        3G20.8)                                                   EQUILB
      STOP 27                                                           EQUILB
   42 IF  (NTV(J).EQ.1)  SEGLP(I1,I2) = X(J)                            EQUILB
      IF  (NTV(J).EQ.2)    YPR(I1,I2) = X(J)                            EQUILB
      IF  (NTV(J).EQ.2)  CALL DRCIJK (D,YPR,IYPR,HT,I2)                 EQUILB
      IF  (NAV(J).LE.0)  GO TO 29                                       EQUILB
      DO  28  K=1,IAV                                                   EQUILB
      J2 = KSG(K,J)                                                     EQUILB
      IF  (NTV(J).EQ.1)  SEGLP(I1,J2) = X(J) - DPN(K,J)                 EQUILB
      IF  (NTV(J).EQ.2)    YPR(I1,J2) = X(J) - DPN(K,J)                 EQUILB
   28 IF  (NTV(J).EQ.2)  CALL DRCIJK (D,YPR,IYPR,HT,J2)                 EQUILB
   29 CONTINUE                                                          EQUILB
   30 IF  (NPRT(27).NE.0)  WRITE  (6,31)  M,I,J,ITER,X(J),FX(J)         EQUILB
   31 FORMAT(4I3,4X,2F12.6)                                             EQUILB
   32 CONTINUE                                                          EQUILB
      IF  (NQ.LE.0)  GO TO 40                                           EQUILB
C                                                                       EQUILB
C     COMPUTE VEHICLE COORDINATES FOR FIXED POINT CONSTRAINTS.          EQUILB
C                                                                       EQUILB
      DO  35  K=1,NQ                                                    EQUILB
      IF  (KQTYPE(K).NE.1)  GO TO 35                                    EQUILB
      IF  (KQ2(K).NE.NVEH)  GO TO 35                                    EQUILB
      L = KQ1(K)                                                        EQUILB
      CALL DOT31(D(1,1,L),RK1(1,K),T)                                   EQUILB
      DO  34  I=1,3                                                     EQUILB
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   34 T(I) = T(I) + SEGLP(I,L) - SEGLP(I,NVEH)                          EQUILB
      CALL MAT31(D(1,1,NVEH),T,RK2(1,K))                                EQUILB
   35 CONTINUE                                                          EQUILB
   40 IF  (NPRT(27).EQ.0)  GO TO 36                                     EQUILB
C                                                                       EQUILB
C     SOLVE SYSTEM EQUATIONS WITH CONSTRAINTS OFF.                      EQUILB
C                                                                       EQUILB
      CALL OUTPUT(0)                                                    EQUILB
      CALL DAUX(0)                                                      EQUILB
      CALL PRINT(6HEQUIL2)                                              EQUILB
      CALL OUTPUT(1)                                                    EQUILB
C                                                                       EQUILB
C     SET UP CONSTRAINTS TO PRODUCE ZERO ACCELERATIONS.                 EQUILB
C                                                                       EQUILB
   36 NQ = NQORG                                                        EQUILB
      IF  (NCON.LE.0)  GO TO 81                                         EQUILB
      DO  37  I=1,NCON                                                  EQUILB
      NQ = NQ+1                                                         EQUILB
      J = IPL(I)                                                        EQUILB
      K = ISG(I)                                                        EQUILB
      NT = NTPL(K,J)                                                    EQUILB
      NTNQ(I) = NTAB(NT+1)                                              EQUILB
      NTAB(NT+1) = -NQ                                                  EQUILB
      KQ1(NQ) = MPL(2,K,J)                                              EQUILB
      KQ2(NQ) = MPL(1,K,J)                                              EQUILB
   37 KQTYPE(NQ) = LTYPE(I)                                             EQUILB
C                                                                       EQUILB
C     SOLVE SYSTEM EQUATIONS WITH CONSTRAINTS ON.                       EQUILB
C                                                                       EQUILB
      CALL OUTPUT(0)                                                    EQUILB
      CALL DAUX(0)                                                      EQUILB
      IF  (NPRT(27).NE.0.AND.JITTER.EQ.1)  CALL PRINT(6HEQUIL1)         EQUILB
C                                                                       EQUILB
C     FETCH CONSTRAINTS FORCES NORMAL TO PLANE SURFACES.                EQUILB
C     STORE FRICTION FORCE AND TURN OFF CONSTRAINTS.                    EQUILB
C                                                                       EQUILB
      CONV = 1.0                                                        EQUILB
      DO  39  I=1,NCON                                                  EQUILB
      MQ = NQORG+I                                                      EQUILB
      J = IPL(I)                                                        EQUILB
      K = ISG(I)                                                        EQUILB
      NT = NTPL(K,J)                                                    EQUILB
      NTAB(NT+1) = NTNQ(I)                                              EQUILB
      M = MPL(2,K,J)                                                    EQUILB
      N = MPL(1,K,J)                                                    EQUILB
      CALL DOT31(D(1,1,N),PL(1,J),TEMP)                                 EQUILB
      T(I) = TEMP(1)*QQ(1,MQ) + TEMP(2)*QQ(2,MQ)+ TEMP(3)*QQ(3,MQ)      EQUILB
      I1 = INDGX(I)                                                     EQUILB
      IF  (I1.GT.0 .AND. DABS(GX(I1)+T(I)).GT.EPS(2))  CONV = 0.0       EQUILB
      IF  (I1.GT.0)  GX(I1) = 0.5*(GX(I1)-T(I))                         EQUILB
      DO  38  L=1,3                                                     EQUILB
   38 TEMP(L) = QQ(L,MQ) - T(I)*TEMP(L)                                 EQUILB
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      LT = NTAB(NT)                                                     EQUILB
   39 CALL MAT31(D(1,1,M),TEMP,TAB(LT+19))                              EQUILB
      NQ = NQORG                                                        EQUILB
      IF  (CONV.EQ.1.0)  GO TO 81                                       EQUILB
   50 CONTINUE                                                          EQUILB
C                                                                       EQUILB
C     PRINT INPUT AND CHANGES MADE.                                     EQUILB
C                                                                       EQUILB
   81 IF  (NJNT.LE.0)  GO TO 86                                         EQUILB
      CALL OUTPUT(0)                                                    EQUILB
      CALL DAUX(0)                                                      EQUILB
      IPRINT = 0                                                        EQUILB
      DO  84  J=1,NJNT                                                  EQUILB
      IF  (IPIN(J).GE.0)  GO TO 84                                      EQUILB
      IF  (VISC(4,3*J-2).GT.0.0)  GO TO 84                              EQUILB
      IF  (IPIN(J).EQ.-1)  T1 = DABS(XDY(HB(1,2*J),D(1,1,J+1),TQ(1,J))) EQUILB
      IF  (IPIN(J).LE.-2)  T1 = DSQRT(TQ(1,J)**2+TQ(2,J)**2+TQ(3,J)**2) EQUILB
      VISC(4,3*J-2) = 1.5*T1                                            EQUILB
      IF  (IPRINT.EQ.0)  WRITE  (6,82)                                  EQUILB
   82 FORMAT('0  THE FOLLOWING VALUES FOR THE MAX TORQUE FOR A LOCKED JOEQUILB
     *INT ON CARDS B.5 HAVE BEEN SET UP BY SUBROUTINE EQUILB:'//        EQUILB
     *        '      J SYM    IPIN    T1=VISC(4)' /)                     EQUILB
      IPRINT = 1                                                        EQUILB
      WRITE  (6,83)  J,JOINT(J),IPIN(J),VISC(4,3*J-2)                   EQUILB
   83 FORMAT(I6,1X,A4,I6,F15.6)                                         EQUILB
   84 CONTINUE                                                          EQUILB
   86 IF  (NQ.LE.0)  GO TO 91                                           EQUILB
      IPRINT = 0                                                        EQUILB
      DO  89  K=1,NQ                                                    EQUILB
      IF  (KQTYPE(K).NE.1)  GO TO 89                                    EQUILB
      IF  (KQ2(K).NE.NVEH)  GO TO 89                                    EQUILB
      IF  (IPRINT.EQ.0)  WRITE  (6,87)                                  EQUILB
   87 FORMAT('0  THE FOLLOWING VALUES FOR RK2 ON CARDS D.6 FOR FIXED POIEQUILB
     *NT CONSTRAINTS HAVE BEEN CHANGED BY SUBROUTINE EQUILB:'//         EQUILB
     *       5X,'K',3X,'KQTYPE',4X,'KQ1',5X,'KQ2',8X,'RK2(X)',          EQUILB
     *       9X,'RK2(Y)',9X,'RK2(Z)'/)                                  EQUILB
      IPRINT = 1                                                        EQUILB
      WRITE  (6,88)  K,KQTYPE(K),KQ1(K),KQ2(K),(RK2(I,K),I=1,3)         EQUILB
   88 FORMAT(I6,3I8,3F15.6)                                             EQUILB
   89 CONTINUE                                                          EQUILB
   91 WRITE  (6,92)                                                     EQUILB
   92 FORMAT('0    THE FOLLOWING VARIABLES ON CARDS G.2 AND G.3 ',      EQUILB
     *       'HAVE BEEN CHANGED BY SUBROUTINE EQUILB:'//)               EQUILB
      DO  95  J=1,NVAR                                                  EQUILB
      I0 = NTV(J)                                                       EQUILB
      I1 = NI1(J)                                                       EQUILB
      I2 = NSG(J)                                                       EQUILB
      WRITE  (6,93)  WORD(I0),I1,I2,SX(J),X(J),BLANK,J,SGX(J),GX(J)     EQUILB
   93 FORMAT(4X,A6,'(',I2,',',I2,') FROM',F12.6,' TO',F12.6,            EQUILB
     *           A4,'AND GX(',I2,') FROM',F12.6,' TO',F12.6)            EQUILB
      IF  (NAV(J).LE.0)  GO TO 95                                       EQUILB
      IAV = NAV(J)                                                      EQUILB
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      DO  94  I=1,IAV                                               EQUILB
      J2 = KSG(I,J)                                                 EQUILB
      ZSX = SX(J) - DPN(I,J)                                        EQUILB
      ZXX =  X(J) - DPN(I,J)                                        EQUILB
   94 WRITE  (6,93)  WORD(IO),I1,J2,ZSX,ZXX                         EQUILB
   95 CONTINUE                                                      EQUILB
      CALL ELTIME (2,35)                                            EQUILB
      RETURN                                                        EQUILB
      END                                                           EQUILB
```

```
      SUBROUTINE EULRAD(D,A,IC)                                          EULRAD
C                                                REV IV    07/23/86TWOPI
C     COMPUTES EULER ANGLES PRECESSION, NUTATION, AND SPIN IN RADIANS    EULRAD
C     AND PLACES THEM INTO THE A ARRAY FOR GIVEN DIRECTION COSINE MATRIXEULRAD
C                                                                        EULRAD
C       ASSUMES  D = D(S)D(N)D(P) , WHERE                                EULRAD
C                                                                        EULRAD
C           CS SS 0          1  0  0          CP SP 0                    EULRAD
C     D(S)=-SS CS 0  , D(N)= 0  CN SN  , D(P)=-SP CP 0                   EULRAD
C           0  0  1          0 -SN CN          0  0  1                   EULRAD
C                                                                        EULRAD
C     AND P=A(1),  N=A(2), S=A(3)                                        EULRAD
C                                                                        EULRAD
C     ROUTINE WILL ALWAYS WORK IN THE MEMORY MODE, I.E., WILL PRODUCE A  EULRAD
C     NEW SET OF A'S THAT DIFFER THE LEAST FROM THE INPUTTED A ARRAY.    EULRAD
C     TO USE IN NON-MEMORY MODE,SET ALL A'S TO ZERO, CALL WITH IC = 8.   EULRAD
C                                                                        EULRAD
C     NEW N IS ALWAYS COMPUTED.                                          EULRAD
C     IF N OR PI-N < 10**-6, IC IS USED TO RESOLVE AMBIGUITES ON P & S,  EULRAD
C     EXCEPT FOR IC = 2 OR 8 WHERE THEY ARE NOT CHANGED.                 EULRAD
C                                                                        EULRAD
      IMPLICIT REAL*8(A-H,O-Z)                                           EULRAD
      DIMENSION A(3),D(3,3),T(6)                                         EULRAD
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                          EULRAD
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                   TWOPI
      IF  (D(3,3).GT. 1.0)  D(3,3) =  1.0                                EULRAD
      IF  (D(3,3).LT.-1.0)  D(3,3) = -1.0                                EULRAD
      B = DACOS(D(3,3))                                                  EULRAD
      T(2) =  B-A(2)                                                     EULRAD
      T(5) = -B-A(2)                                                     EULRAD
      Z = 0.0                                                            EULRAD
      IF  (   B.LT.EPS(6)) Z =  1.0                                      EULRAD
      IF  (PI-B.LT.EPS(6)) Z = -1.0                                      EULRAD
      IF  (Z.NE.0.0)  GO TO 11                                           EULRAD
      T(1) = DATAN2(D(3,1),-D(3,2)) - A(1)                               EULRAD
      T(4) = T(1) + PI                                                   EULRAD
      T(3) = DATAN2(D(1,3), D(2,3)) - A(3)                               EULRAD
      T(6) = T(3) + PI                                                   EULRAD
      GO TO 26                                                           EULRAD
   11 T(1) = DATAN2(D(1,2)-Z*D(2,1) , D(1,1)+Z*D(2,2)) - A(1) - Z*A(3)   EULRAD
      T(3) = T(1)                                                        EULRAD
      GO TO (21,22,23,23,22,21,22,22) , IC                               EULRAD
C                                                                        EULRAD
C     SET T(1) = 0 EXCEPT FOR IC=3,4                                     EULRAD
C     SET T(3) = 0 EXCEPT FOR IC=1,6                                     EULRAD
C                                                                        EULRAD
   21 T(1) = 0.0                                                         EULRAD
      GO TO 25                                                           EULRAD
   22 T(1) = 0.0                                                         EULRAD
   23 T(3) = 0.0                                                         EULRAD
   25 T(4) = T(1)                                                        EULRAD
      T(6) = T(3)                                                        EULRAD
```

```
26    TMAX = 0.0                                                    EULRAD
      J    = 3                                                      EULRAD
      DO 30  I=1,6                                                  EULRAD
      T(I) = DMOD(T(I),TWOPI)                                       EULRAD
      IF  (DABS(T(I)).GT.PI  )  T(I) = T(I) - DSIGN(TWOPI,T(I))     EULRAD
      IF  (DABS(T(I)).LT.TMAX)  GO TO 30                            EULRAD
      TMAX = DABS(T(I))                                             EULRAD
      IF  (I.GT.3)  J = 0                                           EULRAD
30    CONTINUE                                                      EULRAD
      IF  (Z.LT.0.0)  T(J+3) = -T(J+3)                              EULRAD
      DO  40  I=1,3                                                 EULRAD
      IJ = I+J                                                      EULRAD
40    A(I) = A(I) + T(IJ)                                           EULRAD
      RETURN                                                        EULRAD
      END                                                           EULRAD
```

```
      DOUBLE PRECISION FUNCTION EVALFD (D,N,L)                          EVALFD
C                                                  REV IV    07/23/86JTF786
C     EVALUATE FUNCTION THAT IS DEFINED AT LOCATION N OF TAB ARRAY      EVALFD
C     FOR ABSCISSA VALUE D.  EVALUATES DERIVATIVE, FUNCTION OR INTEGRAL EVALFD
C     AS L EQUALS 0, 1, OR 2. TAB ARRAY IS DEFINED AS FOLLOWS:          EVALFD
C        TAB(N)     -  D0 (NO RESTRICTIONS ON D0)                       JTF786
C        TAB(N+1)   -  D1 (F1 DEFINED FOR D0 < D < |D1|)                JTF786
C        TAB(N+2)   -  D2 (F2 DEFINED FOR |D1| < D < |D2|)              JTF786
C        TAB(N+3)   -  (NOT CURRENTLY USED)                             EVALFD
C        TAB(N+4)   -  (NOT CURRENTLY USED)                             EVALFD
C        TAB(N+5)   -  START OF DEFINITION OF 1ST PART OF FUNCTION (F1) EVALFD
C        WHICH IS FOLLOWED BY DEFINITION OF 2ND PART OF FUNCTION (F2),  EVALFD
C                               IF ANY.                                 EVALFD
C        2ND PART OF FUNCTION EXISTS IF D2 IS NON-ZERO.                 EVALFD
C        SIGN OF D1 DETERMINES FORM OF DEFINITION FOR 1ST PART OF       EVALFD
C                              THE FUNCTION.                            EVALFD
C                                                                       EVALFD
C             D1 ZERO INDICATES THAT FUNCTION IS CONSTANT D2 FOR ALL D. EVALFD
C                                                                       EVALFD
C             D1 POSITIVE INDICATES THAT TAB(N+5)-TAB(N+10) CONTAINS    EVALFD
C             A0,A1,...A5.   THE COEFFICIENTS OF A 5TH ORDER POLYNOMIAL.EVALFD
C                                                                       EVALFD
C             D1 NEGATIVE INDICATES THAT TAB(N+5) CONTAINS NP (REAL)    EVALFD
C             FOLLOWED BY   D(1), F(1), D(2), F(2) ..., D(NP), F(NP)    EVALFD
C                                                                       EVALFD
C             WARNING- TABULAR FUNCTION MUST BE DEFINED FOR WHOLE RANGE,EVALFD
C             THAT IS, FROM D0 TO D1 INCLUSIVE,OR D1 TO D2 INCLUSIVE.   EVALFD
C                                                                       EVALFD
C                                                                       EVALFD
C        SIMILARLY, THE SIGN OF D2 (IF NON-ZERO) DETERMINES FORM OF     EVALFD
C        DEFINITION OF 2ND PART OF FUNCTION, IF ANY.                    EVALFD
C                                                                       EVALFD
C                                                                       EVALFD
C     IF D < D0    AND D1# 0, DERIVATIVE = 0 OR FUNCTION = F1(D0)       JTF786
C     IF D > !D1!  AND  D2=0, DERIVATIVE = 0 OR FUNCTION = F1(|D1|)     JTF786
C     IF D > !D2!  AND  D2#0, DERIVATIVE = 0 OR FUNCTION = F2(|D2|)     JTF786
C                                                                       EVALFD
C     NOTE: PREVIOUS VERSIONS ASSUMED THAT D0 WAS NON-NEGATIVE AND      JTF786
C           THAT F = 0 FOR D < D0.                                      JTF786
C                                                                       JTF786
      IMPLICIT REAL*8(A-H,O-Z)                                          EVALFD
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)EVALFD
      F = 0.0                                                           EVALFD
      IOUTR = 0                                                         EVALFD
      D0 = TAB(N)                                                       EVALFD
      D1 = TAB(N+1)                                                     EVALFD
      D2 = TAB(N+2)                                                     EVALFD
      IF  (D1.NE.0.0)  GO TO 26                                         EVALFD
      IF  (L-1)  40,24,25                                               JTF786
   24 F = D2                                                            EVALFD
      GO TO 40                                                          EVALFD
   25 F= (D-D0)*D2                                                      EVALFD
```

```
      GO TO 40                                                          EVALFD
C                                                                       EVALFD
C     COMPUTE INDEX OF F1 DEFINITION                                    EVALFD
C                                                                       EVALFD
   26 NP = N+5                                                          EVALFD
      IF (L.EQ.2) GO TO 41                                              EVALFD
C                                                                       EVALFD
C     DERIVATIVES AND FUNCTIONS HERE, INTEGRALS HAVE OTHER LOGIC        EVALFD
C                                                                       EVALFD
      IF (D.GE.D0) GOTO 22                                              JTF786
C                                                                       JTF786
C     D < D0, RETURN F=0 FOR L=0, OR F=F1(D0) FOR L=1.                  JTF786
C                                                                       JTF786
      IF (L.EQ.0) GOTO 40                                               JTF786
      X = D0                                                            JTF786
      IF (D1.GT.0.0) GOTO 37                                            JTF786
      F = TAB(NP+2)                                                     JTF786
      GOTO 40                                                           JTF786
22    IF (D.LT.DABS(D1)) GOTO 31                                        EVALFD
      IF (D2.NE.0.0) GO TO 32                                           EVALFD
C                                                                       EVALFD
C     D .GE.!D1! , D2 = 0                                               EVALFD
C                                                                       EVALFD
      IF (D1.LE.0.0) GO TO 33                                           EVALFD
C                                                                       EVALFD
C     IOUTR.EQ.1 INDICATES D BEYOND RANGE. DERIVATIVE = 0.              EVALFD
C     IOUTR.EQ.0 INDICATES D.LE.!D1!. COMPUTE POLY DERIVATIVE           EVALFD
C                                                                       EVALFD
      IF (D.GT.DABS(D1)) IOUTR = 1                                      EVALFD
      X = D1                                                            EVALFD
      GO TO 37                                                          EVALFD
C                                                                       EVALFD
C     D0 < D < !D1!                                                     EVALFD
C                                                                       EVALFD
   31 IF (D1.LT.0.0) GO TO 35                                           EVALFD
      X = D                                                             EVALFD
      GO TO 37                                                          EVALFD
C                                                                       EVALFD
C     D .GE. !D1!,  D2 NON-ZERO,  USE F2                                EVALFD
C                                                                       EVALFD
   32 MP = 6                                                            EVALFD
C                                                                       EVALFD
C     COMPUTE INDEX OF F2 DEFINITION                                    EVALFD
C                                                                       EVALFD
      IF (D1.LT.0.0) MP = 2.0 * TAB(NP)+1.0                             EVALFD
      NP = NP+MP                                                        EVALFD
      IF (D.LT.DABS(D2)) GO TO 34                                       EVALFD
      IF (D2.LT.0.0) GO TO 33                                           EVALFD
C                                                                       EVALFD
C     IOUTR.EQ.1 INDICATES D BEYOND RANGE. DERIVATIVE = 0.              EVALFD
C     IOUTR.EQ.0 INDICATES D.LE.!D2!. COMPUTE POLY DERIVATIVE           EVALFD
C                                                                       EVALFD
```

```
      IF (D.GT.DABS(D2)) IOUTR = 1                                      EVALFD
C                                                                       EVALFD
C     D .GE. D2 (POSITIVE), EVALUATE F2 FOR D2                          EVALFD
C                                                                       EVALFD
      X = D2                                                            EVALFD
      GO TO 37                                                          EVALFD
C                                                                       EVALFD
C     D EXCEEDS TABULAR DEFINITION, SET F = F(NP)                       EVALFD
C     IF TABLE DEFINITION EXTENDS BEYOND RANGE, USE TABLE VALUES        EVALFD
C                                                                       EVALFD
   33 MB = TAB(NP)                                                      EVALFD
      NB = NP+MB+MB                                                     EVALFD
      IF (D .LE. TAB(NB-1)) GO TO 35                                    EVALFD
      IF (L.EQ.1) F=TAB(NB)                                             EVALFD
      GO TO 40                                                          EVALFD
C                                                                       EVALFD
C     !D1! .LE. D < !D2!                                                EVALFD
C                                                                       EVALFD
   34 IF (D2.LT.0.0) GO TO 35                                           EVALFD
      X = D                                                             EVALFD
      GO TO 37                                                          EVALFD
C                                                                       EVALFD
C     EVALUATE F FROM TABULAR DEFINITION                                EVALFD
C                                                                       EVALFD
   35 MB = TAB(NP)                                                      EVALFD
      K1 = NP+3                                                         EVALFD
      K2 = NP+MB+MB                                                     EVALFD
      DO 36 K=K1,K2,2                                                   EVALFD
      IF (D.GT.TAB(K)) GO TO 36                                         EVALFD
      IF (L-1) 28,27,40                                                 EVALFD
C                                                                       EVALFD
C     EVALUATE DERIVATIVE FROM TABLE                                    EVALFD
C                                                                       EVALFD
  28   F = (TAB(K+1)-TAB(K-1))/(TAB(K)-TAB(K-2))                        EVALFD
      GO TO 40                                                          EVALFD
C                                                                       EVALFD
C     EVALUATE FUNCTION FROM TABLE                                      EVALFD
C                                                                       EVALFD
  27  R2 = TAB(K)-TAB(K-2)                                              EVALFD
      R1 = (D-TAB(K-2))/R2                                              EVALFD
      R2 = (TAB(K)-D )/R2                                               EVALFD
      F = R1*TAB(K+1)+R2*TAB(K-1)                                       EVALFD
      GO TO 40                                                          EVALFD
   36 CONTINUE                                                          EVALFD
      IF (L.EQ.1) F = TAB(K2)                                           EVALFD
      GO TO 40                                                          EVALFD
   37 IF (IOUTR.EQ.1 .AND. L.EQ.0 ) GO TO 40                            EVALFD
      IF (L-1) 38,39,40                                                 EVALFD
C                                                                       EVALFD
C     EVALUATE DERIVATIVE OF 5TH DEGREE POLYNOMIAL                      EVALFD
C                                                                       EVALFD
  38  F = TAB(NP+1)+X*(2.0*TAB(NP+2)+X*(3.0*TAB(NP+3)+X*(4.0*TAB(NP+4)+ EVALFD
```

```
     *       X*5.0*TAB(NP+5))))                                        EVALFD
      GO TO 40                                                         EVALFD
C                                                                      EVALFD
C     EVALUATE 5TH DEGREE POLYNOMIAL                                   EVALFD
C                                                                      EVALFD
   39 F =      TAB(NP) + X*(TAB(NP+1)+X*(TAB(NP+2)                     EVALFD
     *    +X*(TAB(NP+3)+X*(TAB(NP+4)+X*TAB(NP+5)))))                   EVALFD
      GO TO 40                                                         EVALFD
C                                                                      EVALFD
C     L=2: COMPUTE INTEGRAL OF FUNCTION FROM D0 TO D.                  EVALFD
C                                                                      EVALFD
   41 IF (D.EQ.D0) GO TO 40                                            EVALFD
      X0 = D0                                                          EVALFD
      X1 = D1                                                          EVALFD
      DO 50 I=1,2                                                      EVALFD
      IF (X1) 43,49,42                                                 EVALFD
   42 A0 = TAB(NP  )                                                   EVALFD
      A1 = TAB(NP+1)/2.0                                               EVALFD
      A2 = TAB(NP+2)/3.0                                               EVALFD
      A3 = TAB(NP+3)/4.0                                               EVALFD
      A4 = TAB(NP+4)/5.0                                               EVALFD
      A5 = TAB(NP+5)/6.0                                               EVALFD
      NP = NP+6                                                        EVALFD
      X = X0                                                           EVALFD
      IF (X.NE.0.0) F=F-X*(A0+X*(A1+X*(A2+X*(A3+X*(A4+X*A5)))))        EVALFD
      X = DMIN1(D,X1)                                                  EVALFD
      IF (X.NE.0.0) F=F+X*(A0+X*(A1+X*(A2+X*(A3+X*(A4+X*A5)))))        EVALFD
      IF(D.LE.X1)  GO TO 40                                            EVALFD
      IF(I.EQ.1.AND.D2.NE.0.0)  GO TO 49                               EVALFD
C                                                                      EVALFD
C     NOTE -  NP WAS UPDATED NP=NP+6 BEFORE THIS, READY FOR SECOND PASS EVALFD
C                                                                      EVALFD
      F = F + (D-X1)*(TAB(NP-6)+X1*(TAB(NP-5)+X1*(TAB(NP-4)            EVALFD
     *          +X1*(TAB(NP-3)+X1*(TAB(NP-2)+X1*TAB(NP-1))))))         EVALFD
      GO TO 40                                                         EVALFD
   43 MB = TAB(NP)                                                     EVALFD
      K1 = NP+3                                                        EVALFD
      K2 = NP+MB+MB                                                    EVALFD
      NP = K2+1                                                        EVALFD
      DL = DMIN1(D,DABS(X1))                                           EVALFD
      DO 44 K=K1,K2,2                                                  EVALFD
      IF (X0.GE.TAB(K)) GO TO 44                                       EVALFD
      Z1 = DMAX1(X0,TAB(K-2))                                          EVALFD
      Z2 = DMIN1(DL,TAB(K))                                            EVALFD
      FYX = TAB(K-1)*TAB(K) - TAB(K+1)*TAB(K-2)                        EVALFD
      FY = TAB(K+1) - TAB(K-1)                                         EVALFD
      F = F +(FYX  + 0.5*FY*(Z1+Z2)) *(Z2-Z1)/ (TAB(K)-TAB(K-2))       EVALFD
      IF (Z2.NE.DL) GO TO 44                                           EVALFD
      IF(I.EQ.1.AND.D2.NE.0.0)  GO TO 49                               EVALFD
      IF(Z2. EQ. D) GO TO 40                                           EVALFD
      F = F +(D-Z2)*(FYX+Z2*FY)/ (TAB(K)-TAB(K-2))                     EVALFD
      GO TO 40                                                         EVALFD
```

```
44 CONTINUE                                   EVALFD
49 X0 = DABS(D1)                              EVALFD
50 X1 = D2                                    EVALFD
40 EVALFD = F                                 EVALFD
   RETURN                                     EVALFD
   END                                        EVALFD
```

```
      SUBROUTINE FDINIT                                                 FDINIT
C                                                 REV III.2 08/08/84REVIII
C     REPLACES CODE PREVIOUSLY IN SUBROUTINES FINPUT AND HINPUT.        FDINIT
C     FROM FIVE FUNCTION NUMBERS IN NF ARRAY                            FDINIT
C      1. SET UP KTITLE.                                                FDINIT
C      2. SET UP NTAB AND TAB ARRAYS                                    FDINIT
C      3. INCREMENT COUNTERS MXNTB AND MXTB2                            FDINIT
C                                                                       FDINIT
      IMPLICIT REAL*8 (A-H,O-Z)                                         FDINIT
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/TEMPVS/ JTITLE(5,51),NF(5),MS(3),KTITLE(31),DMMY(34966)    80386
C     NOTE: THIS IS SHARED BY SUBS CINPUT, FINPUT, HINPUT AND FDINIT.   FDINIT
      REAL JTITLE,KTITLE                                                FDINIT
      J1 = MXTB2 + 1                                                    FDINIT
      NT = MXNTB + 1                                                    FDINIT
      NTAB(NT) = J1                                                     FDINIT
      NT = NT+1                                                         FDINIT
      DO 56 L=1,5                                                       FDINIT
      NX = IABS(NF(L))                                                  FDINIT
      NTAB(NT) = 0                                                      FDINIT
      IF (NX.EQ.0) GO TO 56                                             FDINIT
      NTAB(NT) = ISIGN(NTI(NX,,NF(L))                                   FDINIT
      DO 51 KK = 1,5                                                    FDINIT
      KJ = 5*L+KK+1                                                     FDINIT
   51 KTITLE(KJ) = JTITLE(KK,NX)                                        FDINIT
      IF (NTI(NX).NE.0) GO TO 56                                        FDINIT
      WRITE(6,54) NX                                                    FDINIT
   54 FORMAT ('0 FUNCTION NO.',I4,' HAS NOT BEEN DEFINED. ',            FDINIT
     *        '  PROGRAM TERMINATED.')                                  FDINIT
      STOP 15                                                           FDINIT
   56 NT = NT+1                                                         FDINIT
C                                                                       FDINIT
C     INITIALIZE TAB ARRAY TO ZERO EXCEPT FOR DMAX, DINER, FDMAX.       FDINIT
C                                                                       FDINIT
      J2 = J1+29                                                        FDINIT
      DO 57 JJ=J1,J2                                                    FDINIT
   57 TAB(JJ) = 0.0                                                     FDINIT
      NX = NTAB(NT-5)                                                   FDINIT
      IF (NX.LE.0) GO TO 58                                             BUTLER1
      TAB(J1+8) = DABS(TAB(NX+1))                                       FDINIT
      IF (TAB(NX+2).NE.0.0) TAB(J1+8) = DABS(TAB(NX+2))                 FDINIT
      DX = TAB(J1+8)                                                    FDINIT
      TAB(J1+10) = EVALFD(DX,NX,1)                                      FDINIT
      NX = NTAB(NT-4)                                                   FDINIT
      IF (NX.LE.0) GO TO 58                                             FDINIT
      TAB(J1+9) = DABS(TAB(NX+1))                                       FDINIT
      IF (TAB(NX+2).NE.0.0) TAB(J1+9) = DABS(TAB(NX+2))                 FDINIT
   58 J1 = J2+1                                                         FDINIT
      MXNTB = NT-1                                                      FDINIT
      MXTB2 = J1-1                                                      FDINIT
      IF  (MXTB2.GT.4500)  WRITE (6,62) MXTB2                           DIMENB
   62 FORMAT ('0 ERROR IN SUBROUTINE FDINIT, SIZE OF TAB ARRAY =',I8//  FDINIT
```

```
     *        '  PROGRAM TERMINATED.')                              FDINIT
      IF (MXNTB.GT.1250) WRITE (6,63) MXNTB                         DIMENB
   63 FORMAT ('0 ERROR IN SUBROUTINE FDINIT, SIZE OF NTAB ARRAY =',I8// FDINIT
     *        '  PROGRAM TERMINATED.')                              FDINIT
      IF  (MXTB2.GT.4500.OR.MXNTB.GT.1250) STOP 16                  DIMENB
      RETURN                                                        FDINIT
      END                                                           FDINIT
```

```
      SUBROUTINE FINPUT                                                 FINPUT
C                                                     REV IV    02/01/88MISDOT
C     INPUT CARDS F.1-F.5 SPECIFYING THE ALLOWED CONTACTS OF THE CRASH  FINPUT
C     VICTIM BODY SEGMENTS WITH VEHICLE PANELS, BELTS, AIRBAGS AND OTHERFINPUT
C     BODY SEGMENTS ALONG WITH THE ASSOCIATED FUNCTIONS TO BE USED FOR  FINPUT
C     EACH CONTACT.                                                     FINPUT
C     ALSO SETS UP TABLES TO CONTROL TIME HISTORY INFORMATION FOR       FINPUT
C     EACH FUNCTION FOR EACH ALLOWED CONTACT.                           FINPUT
C                                                                       FINPUT
      IMPLICIT REAL*8(A-H,O-Z)                                          FINPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           FINPUT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     FINPUT
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    FINPUT
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), FINPUT
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), FINPUT
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               FINPUT
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           FINPUT
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       FINPUT
     *               JOINT(30),CGS(30),JS(30)                           FINPUT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      FINPUT
      LOGICAL*1 CGS,JS                                                  FINPUT
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   FINPUT
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),FINPUT
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              FINPUT
     *               KQ1(12),KQ2(12),KQTYPE(12)                         FINPUT
      COMMON/WINDFR/ WTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),    WINDOP
     *               MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)       WINDOP
      COMMON/TEMPVS/JTITLE(5,51),NF(5),MS(3),KTITLE(31),DMMY(34966)     80386
C                                                                       FINPUT
      REAL  JTITLE,KTITLE,BLANK,SURFCE(2,3)                             FINPUT
      DATA  BLANK/4H    /                                               FINPUT
      DATA  SURFCE/4H  PL,4HANE ,4H  BE,4HLT  ,4H SEG,4HMENT/           FINPUT
C                                                                       FINPUT
      MXNTI = 50                                                        FINPUT
      MXNTB = 0                                                         FINPUT
      MXTB2 = MXTB1                                                     FINPUT
C                                                                       FINPUT
C     INPUT ALLOWED CONTACTS AND FUNCTIONS BY REF. NO.                  FINPUT
C                                                                       FINPUT
      WRITE (6,31) NPG                                                  PAGE
      NPG=NPG+1                                                         PAGE
   31 FORMAT('1 ALLOWED CONTACTS AND ASSOCIATED FUNCTIONS',80X,         PAGE
     *       'PAGE',I5)                                                 PAGE
      DO 61 I=1,4                                                       FINPUT
      IJK = 0                                                           FINPUT
      GO TO (32,34,35,36),I                                             FINPUT
   32 IF (NPL.LE.0) GO TO 61                                            FINPUT
C                                                                       FINPUT
C     INPUT NO. OF SEGMENTS TO CONTACT EACH PLANE.                      FINPUT
```

```
C       INPUT CARD F.1.A                                                FINPUT
C                                                                       FINPUT
        READ  (5,33) (MNPL(J),J=1,NPL)                                  FINPUT
     33 FORMAT(18I4)                                                    FINPUT
        NJJ = NPL                                                       FINPUT
        GO TO 37                                                        FINPUT
     34 IF (NBLT.LE.0) GO TO 61                                         FINPUT
C                                                                       FINPUT
C       INPUT NO. OF SEGMENTS TO CONTACT EACH BELT.                     FINPUT
C       INPUT CARD F.2.A                                                FINPUT
C                                                                       FINPUT
        READ  (5,33) (MNBLT(J),J=1,NBLT)                                FINPUT
        NJJ = NBLT                                                      FINPUT
        GO TO 37                                                        FINPUT
     35 IF (NSEG.LE.0) GO TO 61                                         FINPUT
C                                                                       FINPUT
C       INPUT NO. OF SEGMENTS TO CONTACT EACH SEGMENT.                  FINPUT
C       INPUT CARD F.3.A                                                FINPUT
C                                                                       FINPUT
        READ  (5,33) (MNSEG(J),J=1,NSEG)                                FINPUT
        NJJ = NSEG                                                      FINPUT
        NSEG1 = NSEG+1                                                  FINPUT
        DO  26  J=NSEG1,NGRND                                           FINPUT
     26 MNSEG(J) = 0                                                    FINPUT
        GO TO 37                                                        FINPUT
     36  IF (NJNT.LE.0) GO TO 61                                        FINPUT
C                                                                       FINPUT
C       INPUT CARD F.4.A                                                FINPUT
C       SUPPLY IGLOB(J)=1 FOR EACH GLOBALGRAPHIC JOINT J=1,NJNT         FINPUT
C                                                                       FINPUT
         READ (5,33) (IGLOB(J),J=1,NJNT)                                FINPUT
        NJJ = NJNT                                                      FINPUT
C                                                                       FINPUT
C       START OF LOOP TO READ CONTACTS FOR PLANES (I=1), BELTS (I=2),   FINPUT
C       SEGMENTS (I=3) AND FUNCTIONS FOR GLOBALGRAPHIC JOINTS (I=4).    FINPUT
C                                                                       FINPUT
     37 DO 60 J=1,NJJ                                                   FINPUT
        IF (I.EQ.1) NK = MNPL(J)                                        FINPUT
        IF (I.EQ.2) NK = MNBLT(J)                                       FINPUT
        IF (I.EQ.3) NK = MNSEG(J)                                       FINPUT
        IF (I.EQ.4) NK = IGLOB(J)                                       FINPUT
        IF (NK.LE.0) GO TO 60                                           FINPUT
        DO 59 K=1,NK                                                    FINPUT
        IF (IJK.EQ.0) WRITE (6,38) I                                    FINPUT
     38 FORMAT('0',119X,'CARDS F.',I1)                                  FINPUT
        IF (IJK.EQ.0 .AND. I.NE.4) WRITE (6,39) SURFCE(1,I),SURFCE(2,I) FINPUT
     39 FORMAT('0',3X,2A4,8X,'SEGMENT',2X,'FORCE DEFLECTION',6X,'INERTIAL FINPUT
       *SPIKE',10X,'R FACTOR',13X,'G FACTOR',10X,'FRICTION COEF. OPT')  EDGE
        IF (IJK.EQ.0 .AND. I.EQ.4) WRITE (6,40)                         FINPUT
     40 FORMAT('0',5X,'JOINT (GLOBALGRAPHIC)',2X,'TORQUE DEFLECTION',6X,'HFINPUT
       *ERRON FORMULA',10X,'R FACTOR',13X,'G FACTOR',10X,'FRICTION COEF.')FINPUT
        IJK = 1                                                         FINPUT
```

```
C                                                                       FINPUT
C     INPUT CONTACT SURFACE NO., SEGMENT NO., AND FUNCTION NOS.         FINPUT
C     INPUT CARD F.(I).(K)                                              FINPUT
C                                                                       FINPUT
      READ  (5,33) NJ,MS,NF,NX                                          EDGE
      WRITE (6,41) NJ,MS,NF,NX                                          EDGE
   41 FORMAT('0',I7,'-',I3,I11,'-',I3,I8,4I21,I12)                      EDGE
      IF (NJ.NE.J) WRITE (6,42)                                         FINPUT
   42 FORMAT(' CONTACT INPUT ERROR. PROGRAM TERMINATED.')               FINPUT
      IF  (NJ.NE.J)  STOP 14                                            FINPUT
      IF (I.NE.2.AND.NF(5).EQ.0) WRITE(6,20)                            MISDOT
20    FORMAT(' FRICTION FUNCTION NUMBER CAN NOT BE ZERO FOR THIS TYPE OFMISDOT
     * CONTACT')                                                        MISDOT
      IF (I.NE.2.AND.NF(5).EQ.0) STOP 105                               MISDOT
      NLT = 1                                                           FINPUT
      DO 43 JJ = 1,31                                                   FINPUT
   43 KTITLE(JJ) = BLANK                                                FINPUT
      GO TO (44,46,48,49),I                                             FINPUT
C                                                                       FINPUT
C     PLACE SEGMENT NO. AND INDEX TO NTAB ARRAY INTO M- AND NT- ARRAYS. FINPUT
C                                                                       FINPUT
   44 MPL(1,K,J) = MS(1)                                                FINPUT
      MPL(2,K,J) = MS(2)                                                FINPUT
      MPL(3,K,J) = MS(3)                                                FINPUT
      NTPL(K,J)  = MXNTB+1                                              FINPUT
      DO 45 JJ = 1,5                                                    FINPUT
   45 KTITLE(JJ) = PLTTL (JJ,J)                                         FINPUT
      GO TO 50                                                          FINPUT
   46 MBLT(1,K,J) = MS(1)                                               FINPUT
      MBLT(2,K,J) = MS(2)                                               FINPUT
      MBLT(3,K,J) = MS(3)                                               FINPUT
      NTBLT(K,J) = MXNTB+1                                              FINPUT
      DO 47 JJ = 1,5                                                    FINPUT
   47 KTITLE(JJ) = BLTTTL (JJ,J)                                        FINPUT
C                                                                       FINPUT
C     SET UP TWO TABLES FOR FULL BELT FRICTION                          FINPUT
C                                                                       FINPUT
      IF (NF(5).NE.0)  NLT = 2                                          FINPUT
      GO TO 50                                                          FINPUT
   48 MSEG(1,K,J) = MS(1)                                               FINPUT
      MSEG(2,K,J) = MS(2)                                               FINPUT
      MSEG(3,K,J) = MS(3)                                               FINPUT
      NTSEG(K,J) = MXNTB+1                                              FINPUT
      KTITLE (3) = SEG(J)                                               FINPUT
      GO TO 50                                                          FINPUT
C                                                                       FINPUT
C       NOTE:  GLOBALGRAPHIC JOINT WILL SAVE NT IN IGLOB ARRAY          FINPUT
C                                                                       FINPUT
   49 IGLOB(J)    = MXNTB+1                                             FINPUT
      KTITLE(2) = JOINT(J)                                              FINPUT
C                                                                       FINPUT
C     SET UP POINTERS TO TAB ARRAY IN NTAB ARRAY.                       FINPUT
```

```
C                                                                      FINPUT
   50 NFJ = MS(2)                                                      FINPUT
      IF (NFJ.GT.0) KTITLE(6) = SEG(NFJ)                               FINPUT
      DO 51 JJ=1,NLT                                                   FINPUT
   51 CALL FDINIT                                                      FINPUT
      WRITE (6,53) KTITLE                                              FINPUT
   53 FORMAT(1X,5A4,1X,A4,5(1X,5A4))                                   FINPUT
      LT = NTAB(MXNTB-5)                                               EDGE
      IF (I.EQ.1) TAB(LT+22) = NX                                      EDGE
      IF (NF(1).NE.0) GO TO 59                                         EDGE
C                                                                      FINPUT
C     IF FORCE DEFLECTION FUNCTION NO. IS ZERO,                        FINPUT
C     SET UP FOR ROLLING CONSTRAINT                                    FINPUT
C                                                                      FINPUT
      NQ = NQ+1                                                        FINPUT
      NTAB(MXNTB-4) = -NQ                                              FINPUT
      KQTYPE(NQ) = -4                                                  FINPUT
      KQ1(NQ) = MS(2)                                                  FINPUT
      KQ2(NQ) = MS(1)                                                  FINPUT
      IF (I.NE.3) GO TO 59                                             EDGE
      KQ1(NQ) = J                                                      FINPUT
      KQ2(NQ) = MS(2)                                                  FINPUT
   59 CONTINUE                                                         FINPUT
   60 CONTINUE                                                         FINPUT
   61 CONTINUE                                                         FINPUT
C                                                                      FINPUT
C     INPUT CARD F.5 - JOINT FUNCTIONS TO BE USED.                     FINPUT
C                                                                      FINPUT
      IF (NJNT.LE.0) GO TO 81                                          FINPUT
      IF  (NJNTF.NE.0)  GO TO 76                                       FINPUT
      DO  75  J=1,NJNT                                                 FINPUT
   75 JOINTF(J) = 0                                                    FINPUT
      GO TO 81                                                         FINPUT
   76 READ  (5,33)  (JOINTF(J),J=1,NJNT)                               FINPUT
      IJK = 0                                                          FINPUT
      DO 80 J=1,NJNT                                                   FINPUT
      IF (JOINTF(J).EQ.0) GO TO 80                                     FINPUT
      IF (IJK.EQ.0) WRITE (6,77) NPG                                   PAGE
      IF (IJK.EQ.0) NPG=NPG+1                                          PAGE
   77 FORMAT('1',122X,'PAGE',I5/120X,'CARD F.5'/                       PAGE
     *        ' THE FOLLOWING JOINT RESTORING FORCE FUNCTIONS AS DEFINED FINPUT
     *ON CARDS E.7 WILL BE USED.'//4X,'JOINT',10X,'FUNCTION'//)        FINPUT
      JF = JOINTF(J)                                                   FINPUT
      IJK = 1                                                          FINPUT
      WRITE (6,78) J,JOINT(J),JF,(JTITLE(I,JF),I=1,5)                  FINPUT
   78 FORMAT(I6,'-',A4,I10,'-',5A4)                                    FINPUT
      IF (NTI(JF).EQ.0) WRITE (6,42)                                   FINPUT
      IF (NTI(JF).EQ.0) STOP 17                                        FINPUT
   80 CONTINUE                                                         FINPUT
C                                                                      FINPUT
C     INPUT CONTACT SEGMENTS FOR AIRBAG, IF ANY.                       FINPUT
C                                                                      FINPUT
```

```
   81 IF (NBAG.LE.0) GO TO 69                                                FINPUT
      IJK = 0                                                                 FINPUT
      DO 68 J=1,NBAG                                                          FINPUT
C                                                                             FINPUT
C     INPUT CARD F.6.(J)•                                                     FINPUT
C                                                                             FINPUT
      READ (5,63) K,NK,(MBAG(2,I,J),MBAG(3,I,J),I=1,NK)                       FINPUT
   63 FORMAT(2I4,20I2)                                                        FINPUT
      MNBAG(J) = NK                                                           FINPUT
      IF (NK.EQ.0) GO TO 68                                                   FINPUT
      IF (IJK.EQ.0) WRITE (6,64)                                              FINPUT
   64 FORMAT(////5X,'AIRBAG',4X,'VS.',4X,'SEGMENTS',90X,'CARDS F.6')          FINPUT
      IF (K.NE.J) WRITE (6,42)                                                FINPUT
      IF (K.NE.J) STOP 20                                                     FINPUT
      WRITE (6,65) J,(MBAG(2,I,J),MBAG(3,I,J),I=1,NK)                         FINPUT
   65 FORMAT('0     NO.',I2,12X,10(I3,'-',I3))                                FINPUT
      DO 66 I=1,NK                                                            FINPUT
      K = MBAG(2,I,J)                                                         FINPUT
   66 KTITLE(I) = SEG(K)                                                      FINPUT
      WRITE (6,67) (BAGTTL(I,J),I=1,5),(KTITLE(I),I=1,NK)                     FINPUT
   67 FORMAT(1X,5A4,10(3X,A4))                                                FINPUT
   68 CONTINUE                                                                FINPUT
C                                                                             FINPUT
C     INPUT CARDS F.7.A F.7.B FOR SUBROUTINE WINDY.                           FINPUT
C                                                                             FINPUT
   69 DO  85  J=1,NGRND                                                       FINPUT
   85 MWSEG(1,J) = 0                                                          FINPUT
      IF (NWINDF.EQ.0) GO TO 99                                               FINPUT
      READ  (5,33)  (MWSEG(1,J),J=1,NSEG)                                     FINPUT
      IPAGE = 0                                                               FINPUT
      DO 73 J=1,NSEG                                                          FINPUT
      IWIND(J) = 0                                                            FINPUT
      WTIME(J) = 0.0                                                          FINPUT
      IF (MWSEG(1,J).EQ.0) GO TO 73                                           FINPUT
      IF (IPAGE.EQ.0) WRITE (6,70) NPG                                        PAGE
      IF (IPAGE.EQ.0) NPG=NPG+1                                               PAGE
   70 FORMAT('1 SEGMENT WIND FORCES',102X,'PAGE',I5/120X,'CARDS F.7'/         PAGE
     *       75X,'DRAG COEFFICIENT     BLOCKING'/                             WINDOP
     *       ' SEGMENT-ELLIPSOID   SEGMENT-PLANE',                            WINDOP
     *       16X,'WIND FORCE FUNCTION',10X,'FUNCTION',9X,                     WINDOP
     *       'SEGMENTS-ELLIPSOID')                                            WINDOP
      IPAGE = 1                                                               FINPUT
      READ(5,86)(MWSEG(I,J),I=1,7),(MOWSEG(J,K),K=1,2*MWSEG(7,J))             WINDOP
   86 FORMAT (7I4,22I2/(I30,7I2))                                             WINDOP
      WRITE(6,71)(MWSEG(I,J),I=1,6)                                           OUT385
   71 FORMAT(1H0,I6,2H -,I3,I13,2H  ,I3,I31,I23)                              OUT385
      IF (IABS(MWSEG(1,J)).NE.J) WRITE (6,42)                                 WINDOP
      IF (IABS(MWSEG(1,J)).NE.J) STOP 21                                      WINDOP
      M3 = MWSEG(3,J)                                                         FINPUT
      M4 = MWSEG(4,J)                                                         FINPUT
      M5 = MWSEG(5,J)                                                         FINPUT
      M6 = MWSEG(6,J)                                                         WINDOP
```

```
      M7 = MWSEG(7,J)                                                  OUT385
      DO 172 II=1,5                                                    FIXWBS
      KTITLE(II)=BLANK                                                 FIXWBS
  172 IF (M6.NE.0) KTITLE(II)=JTITLE(II,M6)                            FIXWBS
      WRITE (6,72) SEG(J),SEG(M3),(PLTTL(I,M4),I=1,5)                  FINPUT
     *             ,(JTITLE(I,M5),I=1,5),(KTITLE(I),I=1,5)             FIXWBS
     *             ,(MOWSEG(J,K),K=1,2*M7)                             OUT385
   72 FORMAT(3X,A4,14X,A4,1H-,5A4,3X,5A4,3X,5A4,2X,3(5(I3,1H-,I3)/94X)) OUT385
   73 CONTINUE                                                         FINPUT
   99 RETURN                                                           FINPUT
      END                                                              FINPUT
```

```
      'SUBROUTINE FLXSEG                                                FLXSEG
C                                                  REV IV    07/23/86TWOPI
       IMPLICIT REAL*8(A-H,O-Z)                                         FLXSEG
       COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,          FLXSEG
      *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG   PAGE
       COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),FLXSEG
      *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)      FLXSEG
       COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)         FLXSEG
       COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                        FLXSEG
      *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                 TWOPI
       COMMON/TEMPVS/ TT(3,3), THN(4), CN1(3,3), CN(3,3), WNM1(3),      FLXSEG
      *               THND(4), PTD(3), WCSN(3), RHSN(3), RHS1(3),       FLXSEG
      *               RHS2(3), GF(3,4), GC(3,3), CGC(3,3), THA(3),      FLXSEG
      *              THAD(3), THADEG(3), DN2N1(3,3), RMG(3),DMMY(35009) 80386
       DIMENSION IDYPR(3)                                               FLXSEG
       DATA      IDYPR/3,2,1/                                           FLXSEG
       IF (NFLX.EQ.0) GO TO 99                                          FLXSEG
       CALL ELTIME(1,34)                                                FLXSEG
       IFX = 1                                                          FLXSEG
    11 N1 = NFLEX(1,IFX)                                                FLXSEG
       N3 = NFLEX(3,IFX)                                                FLXSEG
       CALL DOTT33(D(1,1,N3),D(1,1,N1),TT)                              FLXSEG
       THN(1) =  DATAN2(TT(1,2),TT(1,1))                                FLXSEG
       THN(2) = -DASIN(TT(1,3))                                         FLXSEG
       THN(3) =  DATAN2(TT(2,3),TT(3,3))                                FLXSEG
       THN(4) =  1.0                                                    FLXSEG
       CT22 = 1.0-TT(1,3)**2                                            FLXSEG
       CT2  = DSQRT(CT22)                                               FLXSEG
       ST2  = -TT(1,3)                                                  FLXSEG
       CT1  =  TT(1,1)/CT2                                              FLXSEG
       ST1  =  TT(1,2)/CT2                                              FLXSEG
       CN1(1,1) = -TT(1,1)*TT(1,3)/CT22                                 FLXSEG
       CN1(1,2) = -TT(1,2)*TT(1,3)/CT22                                 FLXSEG
       CN1(1,3) =  1.0                                                  FLXSEG
       CN1(2,1) = -ST1                                                  FLXSEG
       CN1(2,2) =  CT1                                                  FLXSEG
       CN1(2,3) =  0.0                                                  FLXSEG
       CN1(3,1) =  TT(1,1)/CT22                                         FLXSEG
       CN1(3,2) =  TT(1,2)/CT22                                         FLXSEG
       CN1(3,3) =  0.0                                                  FLXSEG
       CALL DOT31(TT,WMEG(1,N3),WNM1)                                   FLXSEG
       DO 12 I=1,3                                                      FLXSEG
    12 WNM1(I) = WNM1(I) - WMEG(I,N1)                                   FLXSEG
       CALL MAT31(CN1,WNM1,THND)                                        FLXSEG
       THND(4) =  0.0                                                   FLXSEG
       CALL CROSS(WMEG(1,N1),WNM1,WCSN)                                 FLXSEG
       RHSN(1) = ( (-THND(1)*ST1*ST2 + THND(2)*CT1/CT2)*WNM1(1)         FLXSEG
      *          +( THND(1)*CT1*ST2 + THND(2)*ST1/CT2)*WNM1(2) )/CT2    FLXSEG
       RHSN(2) =  -THND(1)*(CT1*WNM1(1) + ST1*WNM1(2))                  FLXSEG
       RHSN(3) = ( (-THND(1)*ST1 + THND(2)*CT1*ST2/CT2)*WNM1(1)         FLXSEG
      *          +( THND(1)*CT1 + THND(2)*ST1*ST2/CT2)*WNM1(2) )/CT2    FLXSEG
    13 N2 = NFLEX(2,IFX)                                                FLXSEG
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```
      M = 0                                                             FLXSEG
      DO 15 I=1,3                                                       FLXSEG
      DO 14 J=1,4                                                       FLXSEG
      JM = J+M                                                          FLXSEG
      GF(I,J) = 0.0                                                     FLXSEG
      DO 14 K=1,4                                                       FLXSEG
   14 GF(I,J) = GF(I,J) + HF(K,JM,IFX)*THN(K)                          FLXSEG
   15 M = M+4                                                           FLXSEG
      DO 17 I=1,3                                                       FLXSEG
      THA(I)  = 0.0                                                     FLXSEG
      THAD(I) = 0.0                                                     FLXSEG
      DO 16 J=1,4                                                       FLXSEG
      THA (I) = THA (I) + GF(I,J)*THN (J)                               FLXSEG
   16 THAD(I) = THAD(I) + GF(I,J)*THND(J)                               FLXSEG
      THA (I) = 0.5*THA(I)                                              FLXSEG
   17 THADEG(I) = THA(I)/RADIAN                                         FLXSEG
      CALL DRCYPR (DN2N1,THADEG,IDYPR)                                  FLXSEG
      CALL MAT33(DN2N1,D(1,1,N1),D(1,1,N2))                             FLXSEG
      CSC = DCOS(THA(2))                                                FLXSEG
      CSS = DSIN(THA(2))                                                FLXSEG
      CN(1,1) =   0.0                                                   FLXSEG
      CN(2,1) =   0.0                                                   FLXSEG
      CN(3,1) =   1.0                                                   FLXSEG
      CN(1,2) =  -DSIN(THA(1))                                          FLXSEG
      CN(2,2) =   DCOS(THA(1))                                          FLXSEG
      CN(3,2) =   0.0                                                   FLXSEG
      CN(1,3) =   CSC*CN(2,2)                                           FLXSEG
      CN(2,3) =  -CSC*CN(1,2)                                           FLXSEG
      CN(3,3) =  -CSS                                                   FLXSEG
      CALL MAT33(GF, CN1, GC)                                           FLXSEG
      CALL MAT33(CN, GC, CGC)                                           FLXSEG
      CALL DOT33 (D(1,1,N1),CGC,B42(1,1,3*IFX-2))                       FLXSEG
      CALL DOTT33(B42(1,1,3*IFX-2),TT,B42(1,1,3*IFX))                   FLXSEG
      DO 20 I=1,3                                                       FLXSEG
      DO 20 J=1,3                                                       FLXSEG
      B42(I,J,3*IFX-2) = B42(I,J,3*IFX-2) - D(J,I,N1)                   FLXSEG
      B42(I,J,3*IFX-1) = D(J,I,N2)                                      FLXSEG
   20 B42(I,J,3*IFX  ) = -B42(I,J,3*IFX)                                FLXSEG
C                                                                       FLXSEG
C     COMPUTE V4                                                        FLXSEG
C                                                                       FLXSEG
      CALL MAT31(CGC,WNM1,RHS1)                                         FLXSEG
      DO 21 I=1,3                                                       FLXSEG
   21 RMG(I) = RHS1(I) + WMEG(I,N1)                                     FLXSEG
      CALL MAT31(DN2N1,RMG,WMEG(1,N2))                                  FLXSEG
      CALL CROSS(WMEG(1,N1),RHS1,RHS2)                                  FLXSEG
      CALL MAT31(CGC,WCSN,RHS1)                                         FLXSEG
      DO 25 I=1,3                                                       FLXSEG
   25 RHS1(I) = RHS2(I) - RHS1(I)                                       FLXSEG
      CALL MAT31(GC,WNM1,RHS2)                                          FLXSEG
      RHS1(1) = RHS1(1) - THAD(1)*(CN(2,2)*RHS2(2)-CN(1,2)*CSC*RHS2(3)) FLXSEG
     *                  - THAD(2)*CN(2,2)*CSS*RHS2(3)                   FLXSEG
```

```
      RHS1(2) = RHS1(2) + THAD(1)*(CN(1,2)*RHS2(2)+CN(2,2)*CSC*RHS2(3)) FLXSEG
     *                  + THAD(2)*CN(1,2)*CSS*RHS2(3)                   FLXSEG
      RHS1(3) = RHS1(3) - THAD(2)*CSC*RHS2(3)                           FLXSEG
      CALL MAT31(GF, RHSN, RHS2)                                        FLXSEG
      M = 1                                                             FLXSEG
      DO 30 I=1,3                                                       FLXSEG
      DO  26  J=1,3                                                     FLXSEG
      PTD(J) = 0.0                                                      FLXSEG
      DO  26  K=1,3                                                     FLXSEG
      KK = K+M-1                                                        FLXSEG
   26 PTD(J) = PTD(J) + HF(J,KK,IFX)*THND(K)                            FLXSEG
      RHS2(I) = RHS2(I) + XDY(PTD,CN1,WNM1)                             FLXSEG
   30 M = M+4                                                           FLXSEG
      CALL MAT31(CN, RHS2, PTD)                                         FLXSEG
      DO 35 I=1,3                                                       FLXSEG
   35 RHS1(I) = RHS1(I) + PTD(I)                                        FLXSEG
      CALL DOT31(D(1,1,N1),RHS1,V4(1,IFX))                              FLXSEG
      IF (IFX.EQ.NFLX) GO TO 98                                         FLXSEG
      IFX = IFX+1                                                       FLXSEG
      IF (NFLEX(1,IFX).EQ.N1 .AND. NFLEX(3,IFX).EQ.N3) GO TO 13         FLXSEG
      GO TO 11                                                          FLXSEG
   98 CALL ELTIME(2,34)                                                 FLXSEG
   99 RETURN                                                            FLXSEG
      END                                                               FLXSEG
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      DOUBLE PRECISION FUNCTION FNTERP(THETA,PHI,NT)                    FNTERP
C                                                  REV IV    04/10/87FNFIX
C     COMPUTES THE RESTORING TORQUE OF A JOINT AS A FUNCTION OF THE     FNTERP
C     FLEXURE ANGLE (THETA) AND THE AZIMUTH ANGLE (PHI) AS DEFINED BY   FNTERP
C     FUNCTION NO. NT  .                                                FNTERP
C                                                                       FNTERP
C     ASSUMES  0  < THETA < PI                                          FNTERP
C             -PI <  PHI  < PI                                          FNTERP
C              DATA IN TAB ARRAY CONTAINS NTHETA,NPHI FOLLOWED BY       FNTERP
C              TWO DIMENSIONAL ARRAY OF FUNCTIONAL VALUES (NTHETA > 0)  FNTERP
C              OR POLYNOMIAL COEFFICIENTS (NTHETA < 0) FOR EQUALLY      FNTERP
C              SPACED VALUES OF PHI.                                    FNTERP
C                                                                       FNTERP
C                   THETA(I) - (I-1)*PI/(NTHETA-1) FOR I-1,NTHETA       FNTERP
C                   PHI(J) - -PI + (J-1)*2*PI/NPHI FOR J-1,NPHI         FNTERP
C                       F(THETA,PI) - F(THETA,-PI)                      FNTERP
C                                                                       FNTERP
C     SUBROUTINE EVALUATES G1(THETA) - F(THETA,PHI(J)  )                FNTERP
C                          G2(THETA) - F(THETA,PHI(J+1))                FNTERP
C                FOR  PHI(J) < PHI < PHI(J+1)                           FNTERP
C     BY LINEAR INTERPOLATION OR POLYNOMIAL EVALUATION AND THEN LINEAR  FNTERP
C     INTERPOLATES BETWEEN G1 AND G2 TO OBTAIN F(THETA,PHI).            FNTERP
C     IF F < 0. F IS SET TO ZERO. THEREFORE A DEAD BAND IS OBTAINED     FNTERP
C     BY NEGATIVE VALUES IN THE TABLE.                                  FNTERP
C                                                                       FNTERP
      IMPLICIT REAL*8 (A-H,O-Z)                                         FNTERP
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         FNTERP
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      IERROR - 0                                                        FNTERP
      IF (PHI.LT.-PI)   IERROR - 1                                      FNTERP
      IF (PHI.GT. PI)   IERROR - 2                                      FNTERP
      IF (THETA.LT.0.0) IERROR - 3                                      FNTERP
      IF (THETA.GT.PI ) IERROR - 4                                      FNTERP
      IF (IERROR.NE.0)  WRITE (6,11) IERROR,THETA,PHI,NT                FNTERP
   11 FORMAT('0 IMPROPER ARGUMENTS TO FUNCTION FNTERP. ERROR CODE =',I4/FNTERP
     *       '0 THETA =',G25.15, ' PHI =',G25.15,' NT =',I6)            FNTERP
      IF (IERROR.NE.0) STOP 36                                          FNTERP
      NF - NTI(NT) + 5                                                  FNTERP
      NTHETA - TAB(NF)                                                  FNTERP
      NPHI   - TAB(NF+1)                                                FNTERP
C                                                                       FNTERP
C     DETERMINE INDEX AND INTERPOLATION PARAMETERS FOR PHI.             FNTERP
C                                                                       FNTERP
      IF (PHI.GE.PI-EPS(15)) PHI=0.0-PI                                 FNFIX
      XNP = (PHI+PI)/TWOPI*TAB(NF+1)                                    TWOPI
      NP1 = XNP                                                         FNTERP
      NP2 = NP1+1                                                       FNTERP
      IF (NP2.GE.NPHI) NP2 = 0                                          FNTERP
      RP2 - XNP - DFLOAT(NP1)                                           FNTERP
      RP1 = 1.0 - RP2                                                   FNTERP
      NTH - IABS(NTHETA)                                                FNTERP
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      IP1 = NF+1+NP1*NTH                                                FNTERP
      IP2 = NF+1+NP2*NTH                                                FNTERP
C                                                                       FNTERP
C     DETERMINE INDEX AND INTERPOLATION PARAMETERS FOR THETA.           FNTERP
C                                                                       FNTERP
      IF (NTHETA.LT.0) GO TO 20                                         FNTERP
      XNT = THETA/PI*(TAB(NF)-1.0)                                      FNTERP
      NT1 = XNT                                                         FNTERP
      RT2 = XNT - DFLOAT(NT1)                                           FNTERP
      RT1 = 1.0 - RT2                                                   FNTERP
      IT1 = IP1 + NT1                                                   FNTERP
      IT2 = IP2 + NT1                                                   FNTERP
      G1  = RT1*TAB(IT1+1) + RT2*TAB(IT1+2)                             FNTERP
      G2  = RT1*TAB(IT2+1) + RT2*TAB(IT2+2)                             FNTERP
      GO TO 23                                                          FNTERP
C                                                                       FNTERP
C     COMPUTE FOR POLYNOMIALS IN THETA FOR FIXED PHI.                   FNTERP
C                                                                       FNTERP
   20 NPOLY = -NTHETA-1                                                 FNTERP
      IT1 = IP1 + NPOLY + 2                                             FNTERP
      IT2 = IP2 + NPOLY + 2                                             FNTERP
      THETA1 = THETA - TAB(IP1+1)                                       FNTERP
      THETA2 = THETA - TAB(IP2+1)                                       FNTERP
      G1 = 0.0                                                          FNTERP
      G2 = 0.0                                                          FNTERP
      DO 21 I=1,NPOLY                                                   FNTERP
      IT1 = IT1-1                                                       FNTERP
      IT2 = IT2-1                                                       FNTERP
      G1 = THETA1*(TAB(IT1)+G1)                                         FNTERP
   21 G2 = THETA2*(TAB(IT2)+G2)                                         FNTERP
      IF (THETA1.LT.0.0) G1=0.0                                         FNFIX
      IF (THETA2.LT.0.0) G2=0.0                                         FNFIX
   23 FNTERP = RP1*G1 + RP2*G2                                          FNTERP
      IF (FNTERP.LT.0.0) FNTERP = 0.0                                   FNTERP
      RETURN                                                            FNTERP
      END                                                               FNTERP
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      SUBROUTINE FRCDFL (D,RATE,M,N,FRCDF,ELOSS)                        FRCDFL
C                                                 REV III.2 08/08/84REVIII
C     EVALUATE FORCE DEFLECTION FUNCTION AT POINT D, WHERE DEFINITION   FRCDFL
C     OF FUNCTION IS CONTROLLED BY M INDEX OF NTAB ARRAY.               FRCDFL
C     DERIVATIVE, FUNCTION OR INTEGRAL IS EVALUATED AS N = 0,1 OR 2.    FRCDFL
C        NTAB(M)     -  INDEX TO TAB ARRAY FOR REAL DATA                FRCDFL
C        NTAB(M+1)   -  INDEX TO TAB ARRAY FOR BASE FUNCTION            FRCDFL
C        NTAB(M+2)   -  INDEX TO TAB ARRAY FOR INERTIAL FUNCTION, IF ANY FRCDFL
C                                                                       FRCDFL
C     ASSUMES  0 < DG < DCUBIC < DREF < DMAX                            FRCDFL
C                BUT ANY < MAY BE LESS THAN OR EQUAL TO                 FRCDFL
C                                                                       FRCDFL
      IMPLICIT REAL*8(A-H,O-Z)                                          FRCDFL
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      F = 0.0                                                           FRCDFL
      ELOSS = 0.0                                                       FRCDFL
      L = NTAB(M)                                                       FRCDFL
      TAB(L) = D                                                        FRCDFL
      IF (D.LT.0.0) GO TO 99                                            FRCDFL
      DMAX = TAB(L+8)                                                   FRCDFL
      IF (D.LT.DMAX) GO TO 10                                           FRCDFL
C                                                                       FRCDFL
C     DMAX < D , USE MAX VALUE                                          FRCDFL
C                                                                       FRCDFL
      IF (N-1)  99,9,99                                                 FRCDFL
    9 FDMAX = TAB(L+10)                                                 FRCDFL
      F = FDMAX                                                         FRCDFL
      GO TO 40                                                          FRCDFL
   10 DREF = TAB(L+7)                                                   FRCDFL
      IF (D.GE.DREF) GO TO 30                                           FRCDFL
      DCUBIC = TAB(L+6)                                                 FRCDFL
      IF (DCUBIC GE.DREF) GO TO 20                                      FRCDFL
      IF (D.LE.DCUBIC) GO TO 20                                         FRCDFL
C                                                                       FRCDFL
C     DCUBIC < D < DREF , USE CUBIC                                     FRCDFL
C                                                                       FRCDFL
      LC = L+14                                                         FRCDFL
      DC0 = TAB(L+18)                                                   FRCDFL
      X = D-DC0                                                         FRCDFL
      IF (N-1) 12,11,99                                                 FRCDFL
C                                                                       FRCDFL
C     USE CUBIC DEFINITION                                              FRCDFL
C                                                                       FRCDFL
   11 F = TAB(LC) + X *(TAB(LC+1)+X*(TAB(LC+2)+X*TAB(LC+3)))            FRCDFL
      GO TO 40                                                          FRCDFL
C                                                                       FRCDFL
C     USE DERIVATIVE OF CUBIC                                           FRCDFL
C                                                                       FRCDFL
   12 F = TAB(LC+1)+X*(2.0*TAB(LC+2)+X*3.0*TAB(LC+3))                   FRCDFL
      GO TO 99                                                          FRCDFL
   20 DG = TAB(L+5)                                                     FRCDFL
      IF (D.LE.DG) GO TO 40                                             FRCDFL
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C                                                                       FRCDFL
C     DG < D < DCUBIC , USE QUADRATIC                                   FRCDFL
C                                                                       FRCDFL
      LQ = L+11                                                         FRCDFL
      X = D-DG                                                          FRCDFL
      IF (N-1) 22,21,99                                                 FRCDFL
C                                                                       FRCDFL
C     USE QUADRATIC DEFINITION                                          FRCDFL
C                                                                       FRCDFL
   21 F = TAB(LQ)+X*(TAB(LQ+1)+X*TAB(LQ+2))                             FRCDFL
      GO TO 40                                                          FRCDFL
C                                                                       FRCDFL
C     USE DERIVATIVE OF QUADRATIC.                                      FRCDFL
C                                                                       FRCDFL
   22 F = TAB(LQ+1)+X*2.0*TAB(LQ+2)                                     FRCDFL
      GO TO 99                                                          FRCDFL
C                                                                       FRCDFL
C     DREF < D < DMAX, USE BASE FUNCTION                                FRCDFL
C                                                                       FRCDFL
   30 IF (N-1) 31,31,99                                                 FRCDFL
   31 NB = NTAB(M+1)                                                    FRCDFL
C                                                                       FRCDFL
C     EVALUATE BASE FUNCTION                                            FRCDFL
C                                                                       FRCDFL
      IF (NB.GT.0) F = EVALFD(D,NB,N)                                   FRCDFL
      NI = NTAB(M+2)                                                    FRCDFL
C                                                                       FRCDFL
C     ADD INERTIAL FUNCTION , IF ANY                                    FRCDFL
C                                                                       FRCDFL
      IF (NI.GT.0) F = F+EVALFD(D,NI,N)                                 FRCDFL
   40 IF  (N.NE.1)  GO TO 99                                            FRCDFL
C                                                                       FRCDFL
C     COMPUTE AND ADD RATE DEPENDENT FUNCTIONS, IF ANY.                 FRCDFL
C                                                                       FRCDFL
C     CURRENT RESTRICTIONS:                                             FRCDFL
C                                                                       FRCDFL
C        1) COMPUTED FOR N=1 (FUNCTION) ONLY.                           FRCDFL
C                                                                       FRCDFL
C        2) FUNCTION NOS. M+2,M+3 AND M+4 (USED FOR INERTIAL SPIKE,     FRCDFL
C           R FACTOR AND G FACTOR FUNCTIONS) MUST BE NEGATIVE OR ZERO,  FRCDFL
C           I.E., THESE FUNCTIONS CANNOT BE USED IN CONJUNCTION WITH    FRCDFL
C           THE RATE DEPENDENT FUNCTIONS.                               FRCDFL
C                                                                       FRCDFL
C        3) ASSUMES THE FUNCTIONAL FORM                                 FRCDFL
C                                                                       FRCDFL
C                 F(D,D') = F1(D) + F2(D)*F3(D') + F4(D')               FRCDFL
C                                                                       FRCDFL
C           WHERE F1(D ) IS DEFINED BY FUNCTION NTAB(M+1)>0,            FRCDFL
C                        I.E., NORMAL FORCE DEFLECTION FUNCTION WITH NO FRCDFL
C                        INERTIAL SPIKE FUNCTION AND DEFAULT VALUES     FRCDFL
C                        R=1 AND G=0 (UNLOADING AND RELOADING SAME AS   FRCDFL
C                        ORIGINAL LOADING);                             FRCDFL
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C                                                                       FRCDFL
C                F2(D ) IS DEFINED BY FUNCTION NTAB(M+2)<0,             FRCDFL
C                       IF NTAB(M+2)=0, F2(D )=0;                       FRCDFL
C                                                                       FRCDFL
C                F3(D') IS DEFINED BY FUNCTION NTAB(M+3)<0,             FRCDFL
C                       IF NTAB(M+3)=0, F3(D')=0;                       FRCDFL
C                                                                       FRCDFL
C          AND   F4(D') IS DEFINED BY FUNCTION NTAB(M+4)<0,             FRCDFL
C                       IF NTAB(M+4)=0, F4(D')=0.                       FRCDFL
C                                                                       FRCDFL
C          NOTE: FUNCTIONAL FORM CAN BE CHANGED BY REVISING PROGRAM     FRCDFL
C          BETWEEN STATEMENTS 40 AND 99.                                FRCDFL
C                                                                       FRCDFL
      F2 = 0.0                                                          FRCDFL
      F3 = 0.0                                                          FRCDFL
      F4 = 0.0                                                          FRCDFL
      N2 = -NTAB(M+2)                                                   FRCDFL
      N3 = -NTAB(M+3)                                                   FRCDFL
      N4 = -NTAB(M+4)                                                   FRCDFL
      IF  (N2.GT.0)  F2 = EVALFD (D,   N2,N)                            FRCDFL
      IF  (N3.GT.0)  F3 = EVALFD (RATE,N3,N)                            FRCDFL
      IF  (N4.GT.0)  F4 = EVALFD (RATE,N4,N)                            FRCDFL
      F = F + F2*F3 + F4                                                FRCDFL
      ELOSS = RATE*(F2*F3+F4)                                           FRCDFL
   99 FRCDF = F                                                         FRCDFL
      RETURN                                                            FRCDFL
      END                                                               FRCDFL
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```
      SUBROUTINE FSMSOL (C,R,NN,MX,MAXN,JN,MAXDIM)                      FSMSOL
C                                                 REV III.2 08/08/84REVIII
C        SOLVES A SET OF SIMULTANEOUS EQUATIONS  OF SIZE 3*MM           FSMSOL
C        WHERE THE MATRIX CONSISTS OF A SET OF 3*3 SUBMATRICES          FSMSOL
C        STORED IN  C(3,3,IJ). THE LOCATION OF THE I,J ELEMENT          FSMSOL
C        IS  STORED IN   NN(I,J).  I.E.  IJ= NN(I,J)                    FSMSOL
C                                                                       FSMSOL
C        A NEGATIVE IJ IMPLIES THAT C( , ,!IJ!) IS AN                   FSMSOL
C        IDENTITY AND THE RIGHT SIDE IS ZERO. A NEGATIVE                FSMSOL
C        IJ WILL ONLY OCCUR ON A DIAGONAL ENTRY OF NN.                  FSMSOL
C                                                                       FSMSOL
C            THE  BASIC EQUATION IS   CX=R                              FSMSOL
C                                                                       FSMSOL
C           DURING THE SOLUTION THE C MATRIX IS DESTROYED ,IT MAY       FSMSOL
C           BE NECESSARY TO ADD TO THE C ARRAY.                         FSMSOL
C           THE SOLUTION IS STORED IN R.                                FSMSOL
C                                                                       FSMSOL
C       INPUT                                                           FSMSOL
C                                                                       FSMSOL
C           C(3,3,K)  GIVEN ARRAY                                       FSMSOL
C           R(3,MM)   GIVEN RIGHT HAND SIDE                             FSMSOL
C           NN(JJ,JJ) GIVEN ARRAY CONTAINING LOCATIONS OF I,J,ELEMENT   FSMSOL
C           MX        SIZE OF SYSTEM OF SUBMATRICES (POSITIVE INDICATES FSMSOL
C                     THAT C MATRIX IS SYMMETRIC, NEGATIVE IT IS NOT.)  FSMSOL
C           MAXN      LARGEST VALUE IN NN ARRAY                         FSMSOL
C           JN        DIMENSION OF NN                                   FSMSOL
C           MAXDIM    THIRD DIMENSION OF C IN CALLING ROUTINE           FSMSOL
C                                                                       FSMSOL
      IMPLICIT REAL*8 (A-H,O-Z)                                         FSMSOL
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           PAGE
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      DIMENSION C(3,3,1),R(3,1),NN(JN,1)                                FSMSOL
      CALL ELTIME(1,20)                                                 FSMSOL
      MM = IABS(MX)                                                     FSMSOL
      IF  (MM.LE.0)  GO TO 99                                           FSMSOL
      MM1 = MM-1                                                        FSMSOL
      MP1 = MM+1                                                        FSMSOL
      DO  50  II=1,MM                                                   FSMSOL
      I = MP1-II                                                        FSMSOL
C                                                                       FSMSOL
C     START PIVOT AT BOTTOM - FIND PIVOT - INVERT.                      FSMSOL
C                                                                       FSMSOL
      L = NN(I,I)                                                       FSMSOL
      IF  (L.LE.0)  GO TO 50                                            FSMSOL
      DO  14  M=1,3                                                     FSMSOL
      B = 1.0/C(M,M,L)                                                  FSMSOL
      C(M,M,L) = 1.0                                                    FSMSOL
      C(M,1,L) = B*C(M,1,L)                                             FSMSOL
      C(M,2,L) = B*C(M,2,L)                                             FSMSOL
      C(M,3,L) = B*C(M,3,L)                                             FSMSOL
      R(M,I)   = B*R(M,I)                                               FSMSOL
      DO  13  N=1,3                                                     FSMSOL
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      IF  (N.EQ.M)  GO TO 13                                            FSMSOL
      B = C(N,M,L)                                                      FSMSOL
      C(N,M,L) = 0.0                                                    FSMSOL
      C(N,1,L) = C(N,1,L) - B*C(M,1,L)                                  FSMSOL
      C(N,2,L) = C(N,2,L) - B*C(M,2,L)                                  FSMSOL
      C(N,3,L) = C(N,3,L) - B*C(M,3,L)                                  FSMSOL
      R(N,I)   = R(N,I)   - B*R(M,I)                                    FSMSOL
   13 CONTINUE                                                          FSMSOL
   14 CONTINUE                                                          FSMSOL
C                                                                       FSMSOL
C     CHECK IF DONE.                                                    FSMSOL
C                                                                       FSMSOL
      IF  (I.EQ.1)  GO TO 50                                            FSMSOL
      IM1 = I-1                                                         FSMSOL
C                                                                       FSMSOL
C     CALCULATE PIVOT ROW.                                              FSMSOL
C                                                                       FSMSOL
      DO  20  J=1,IM1                                                   FSMSOL
      IF  (NN(I,J).EQ.0)  GO TO 20                                      FSMSOL
      M = NN(I,J)                                                       FSMSOL
      DO  15  N=1,3                                                     FSMSOL
      A = C(1,1,L)*C(1,N,M) + C(1,2,L)*C(2,N,M) + C(1,3,L)*C(3,N,M)    FSMSOL
      B = C(2,1,L)*C(1,N,M) + C(2,2,L)*C(2,N,M) + C(2,3,L)*C(3,N,M)    FSMSOL
      D = C(3,1,L)*C(1,N,M) + C(3,2,L)*C(2,N,M) + C(3,3,L)*C(3,N,M)    FSMSOL
      C(1,N,M) = A                                                      FSMSOL
      C(2,N,M) = B                                                      FSMSOL
   15 C(3,N,M) = D                                                      FSMSOL
   20 CONTINUE                                                          FSMSOL
C                                                                       FSMSOL
C     DONE WITH PIVOT ROW - ZERO COLUMN I ABOVE DIAGONAL.               FSMSOL
C                                                                       FSMSOL
C     1,1                                                               FSMSOL
C         .                                                             FSMSOL
C            .                                        .                 FSMSOL
C              K,K .   . K,J .   . K,I            C   = C   - C  *C     FSMSOL
C                .  ..     .        .              KJ    KJ    KI  IJ   FSMSOL
C                .      .  .        .                                   FSMSOL
C              J,K .   . J,J .   . J,I            C   = C   - C  *C     FSMSOL
C                .         .   .    .              JK    JK    JI  IK   FSMSOL
C                .         .     .  .                                   FSMSOL
C              I,K .   . I,J .   . I,I            C   = 0               FSMSOL
C                                       .          KI                   FSMSOL
C                                          .                            FSMSOL
C                                             M,M                       FSMSOL
C                                                                       FSMSOL
      DO  40  K=1,IM1                                                   FSMSOL
      KI = NN(K,I)                                                      FSMSOL
      IK = NN(I,K)                                                      FSMSOL
      IF  (KI.EQ.0 .AND. IK.EQ.0)  GO TO 40                             FSMSOL
      DO  30  J=K,IM1                                                   FSMSOL
      IJ = NN(I,J)                                                      FSMSOL
      JI = NN(J,I)                                                      FSMSOL
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      IF  (KI.EQ.0  .OR. IJ.EQ.0)  GO TO 24                          FSMSOL
      KJ = NN(K,J)                                                    FSMSOL
      IF  (KJ.NE.0)  GO TO 22                                         FSMSOL
      MAXN = MAXN+1                                                   FSMSOL
      IF  (MAXN.GT.MAXDIM)  GO TO 41                                  FSMSOL
      KJ = MAXN                                                       FSMSOL
      NN(K,J) = KJ                                                    FSMSOL
      DO  21  M=1,3                                                   FSMSOL
      DO  21  N=1,3                                                   FSMSOL
   21 C(N,M,KJ) = 0.0                                                 FSMSOL
   22 DO  23  M=1,3                                                   FSMSOL
      DO  23  N=1,3                                                   FSMSOL
   23 C(N,M.KJ) = C(N,M,KJ) - C(N,1,KI)*C(1,M,IJ)                     FSMSOL
     *                      - C(N,2,KI)*C(2,M,IJ)                     FSMSOL
     *                      - C(N,3,KI)*C(3,M,IJ)                     FSMSOL
   24 IF  (J.EQ.K)  GO TO 30                                          FSMSOL
      IF  (JI.EQ.0  .OR. IK.EQ.0)  GO TO 30                           FSMSOL
      JK = NN(J,K)                                                    FSMSOL
      IF  (JK.NE.0)  GO TO 26                                         FSMSOL
      MAXN = MAXN+1                                                   FSMSOL
      IF  (MAXN.GT.MAXDIM)  GO TO 41                                  FSMSOL
      JK = MAXN                                                       FSMSOL
      NN(J,K) = JK                                                    FSMSOL
      DO  25  M=1,3                                                   FSMSOL
      DO  25  N=1,3                                                   FSMSOL
   25 C(N,M,JK) = 0.0                                                 FSMSOL
   26 IF  (MX.LT.0)  GO TO 28                                         FSMSOL
      DO  27  M=1,3                                                   FSMSOL
      DO  27  N=1,3                                                   FSMSOL
   27 C(N,M,JK) = C(M,N,KJ)                                           FSMSOL
      GO TO 30                                                        FSMSOL
   28 DO  29  M=1,3                                                   FSMSOL
      DO  29  N=1,3                                                   FSMSOL
   29 C(N,M,JK) = C(N,M,JK) - C(N,1,JI)*C(1,M,IK)                     FSMSOL
     *                      - C(N,2,JI)*C(2,M,IK)                     FSMSOL
     *                      - C(N,3,JI)*C(3,M,IK)                     FSMSOL
   30 CONTINUE                                                        FSMSOL
      IF  (KI.EQ.0)  GO TO 40                                         FSMSOL
      DO  35  N=1,3                                                   FSMSOL
   35 R(N,K) = R(N,K)  - C(N,1,KI)*R(1,I)                             FSMSOL
     *                 - C(N,2,KI)*R(2,I)                             FSMSOL
     *                 - C(N,3,KI)*R(3,I)                             FSMSOL
   40 CONTINUE                                                        FSMSOL
   50 CONTINUE                                                        FSMSOL
      GO TO 51                                                        FSMSOL
   41 WRITE  (6,49)  MAXDIM,NPG,(L,L=1,MM)                            PAGE
      NPG=NPG+1                                                       PAGE
      DO  42  I=1,MM                                                  FSMSOL
   42 WRITE  (6,43)  I,(NN(I,L),L=1,MM)                               FSMSOL
   43 FORMAT(I3,3X,40I3,3X/6X,40I3)                                   FSMSOL
      WRITE  (6,44) NPG                                               PAGE
      NPG=NPG+1                                                       PAGE
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  44  FORMAT('1 FSMSOL PRINT OF RHS ARRAY',96X,'PAGE',I5//)               PAGE
      DO  45  K=1,MM                                                      FSMSOL
  45  WRITE  (6,46)  K,(R(I,K),I=1,3)                                     FSMSOL
  46  FORMAT(I6,9G14.7)                                                   FSMSOL
      WRITE  (6,47) NPG                                                   PAGE
      NPG=NPG+1                                                           PAGE
  47  FORMAT('1 FSMSOL PRINT OF C ARRAY ELEMENTS',89X,'PAGE',I5//)        PAGE
      DO  48  K=1,MAXN                                                    FSMSOL
  48  WRITE  (6,46)  K,((C(I,L,K),L=1,3),I=1,3)                           FSMSOL
  49  FORMAT('1 MAXIMUM DIMENSION OF',I4,' ON C ARRAY HAS BEEN EXCEEDED FSMSOL
     *IN SUBROUTINE FSMSOL.',46X,'PAGE',I5//' IF 600, CALL IS FROM SUBROPAGE
     *UTINE DAUX. IF 200'                                                 PAGE
     * ,' CALL IS FROM SUBROUTINE HPTURB.'//' PROGRAM IS BEING TERMINATEPAGE
     *D. COMPLETE PRINT-OUT OF IJK, RHS AND C ARRAYS FOLLOW.'//           FSMSOL
     *' FSMSOL PRINT OF IJK MATRIX'//(6X,40I3))                           FSMSOL
      STOP 35                                                             FSMSOL
C                                                                         FSMSOL
C     BACKDOWN SOLUTION                                                   FSMSOL
C                                                                         FSMSOL
  51  IF  (MM.EQ.1)  GO TO 99                                             FSMSOL
      DO  90  J=1,MM1                                                     FSMSOL
      IP = J+1                                                            FSMSOL
      DO  80  I=IP,MM                                                     FSMSOL
      IF  (NN(I,J).EQ.0)  GO TO 80                                        FSMSOL
      IJ = NN(I,J)                                                        FSMSOL
      DO  75  N=1,3                                                       FSMSOL
  75  R(N,I) = R(N,I) - C(N,1,IJ)*R(1,J)                                  FSMSOL
     *                - C(N,2,IJ)*R(2,J)                                  FSMSOL
     *                - C(N,3,IJ)*R(3,J)                                  FSMSOL
  80  CONTINUE                                                            FSMSOL
  90  CONTINUE                                                            FSMSOL
  99  CALL ELTIME(2,20)                                                   FSMSOL
      RETURN                                                              FSMSOL
      END                                                                 FSMSOL
```

```
      SUBROUTINE GLOBAL (J,HD3,DH1,TQC,T9,ANGL)                         GLOBAL
C                                                  REV IV    07/24/86SLIP
      IMPLICIT REAL*8 (A-H,O-Z)                                         GLOBAL
      DIMENSION HD3(3),DH1(3,3),T9(3),ANGL(3),CC(3)                     GLOBAL
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     GLOBAL
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    GLOBAL
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           GLOBAL
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         GLOBAL
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      IF (DABS(HD3(3)).GT.1.0-EPS(6)) GO TO 34                          GLOBAL
      ANGL(1) = DACOS(HD3(3))                                           GLOBAL
      NT = IGLOB(J)                                                     GLOBAL
      NT1 = NTAB(NT+2)                                                  GLOBAL
      CALL HERRON(HD3,NT1,THETO,THETOP)                                 GLOBAL
      JSTOP(4,1,J) = 0                                                  GLOBAL
      IF (ANGL(1).LE.THETO) GO TO 34                                    GLOBAL
      JSTOP(4,1,J) = 1                                                  GLOBAL
      MT = NTAB(NT+5)                                                   GLOBAL
      CREST = TAB(MT+3)                                                 GLOBAL
      STH2 = 1.0-HD3(3)**2                                              GLOBAL
      STH = DSQRT(STH2)                                                 GLOBAL
      CTH = HD3(3)/STH                                                  GLOBAL
      CST = DSQRT(STH2+THETOP**2)                                       GLOBAL
      DR  = (ANGL(1)-THETO)*STH/CST                                     GLOBAL
      LT  = NTAB(NT)                                                    GLOBAL
      TAB(LT) = DR                                                      GLOBAL
      NTAB(NT+2) = 0                                                    GLOBAL
      DRDOT = 0.0                                                       GLOBAL
      CALL FRCDFL (DR,DRDOT,NT,1,TQF,ELOSS)                             GLOBAL
      NTAB(NT+2) = NT1                                                  GLOBAL
      TQC = TQF/CST                                                     GLOBAL
      CC(1) = -HD3(2)+HD3(1)*CTH*THETOP                                 GLOBAL
      CC(2) =  HD3(1)+HD3(2)*CTH*THETOP                                 GLOBAL
      CC(3) =                -STH*THETOP                                GLOBAL
      DO 28 L=1,3                                                       GLOBAL
   28 T9(L) = CC(1)*DH1(L,1) + CC(2)*DH1(L,2) + CC(3)*DH1(L,3)          GLOBAL
   34 RETURN                                                            GLOBAL
      END                                                               GLOBAL
```

```
      SUBROUTINE HBELT (J1,J2,KNLO,IND)                                 HBELT
C                                                   REV IV    02/01/88MISDOT
C     ARGUMENTS:                                                        HBELT
C         J1,J2 - FIRST AND LAST INDEX FOR BELTS.                       HBELT
C          KNLO - ZERO VALUE FOR KNL INDEX.                             HBELT
C           IND - 0: CALL IS FROM SUBROUTINE CONTCT                     HBELT
C                 1: CALL IS FROM SUBROUTINE UPDATE                     HBELT
C                                                                       HBELT
      IMPLICIT REAL*8 (A-H,O-Z)                                         HBELT
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         MISDOT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  MISDOT
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),HBELT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       HBELT
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         HBELT
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       HBELT
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          HBELT
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         HBELT
C     THIS COMMON/TEMPVS/ IS SHARED BY HPTURB, HBPLAY, HBELT AND HSETC. HBELT
      COMMON/TEMPVS/ B(3,3,3),S(3,3),T(3),R(3),V(3),T1(3),T2(3),        HBELT
     *               E(3,3,50),EDOT(3,50),FCE(3,50),FR(3,50),ZR(3,50),  HBELT
     *               TR(3,50),U(3,50),PTLOSS(2,50),BL(50),FB(50),FP(50),HBELT
     *               OLDBB(100),RHS(3,54),C(3,3,200),IJK(54,54)         HBELT
     *              ,DMMY(29942)                                        80386
      CALL ELTIME (1,38)                                                HBELT
      NTP = 0                                                           HBELT
      K2 = 0                                                            HBELT
      DO  31  JB=J1,J2                                                  HBELT
      IF  (IND.EQ.0)  NBSF = NBSF + 1                                   HBELT
      IF  (NPTPLY(JB).LE.0)  GO TO 31                                   HBELT
C                                                                       HBELT
C     FIRST LOOP ON K                                                   HBELT
C     COMPUTE Z(K),ZR(K),E3(K),U(K-1),BL(K-1),FB(K-1)                   HBELT
C     NEED    NL(K),BB(K-1)                                             HBELT
C     NOTE: AN INDEX K-1 REFERS TO BELT SEGMENT BETWEEN K-1 AND K.      HBELT
C                                                                       HBELT
      K1 = K2 + 1                                                       HBELT
      K2 = K2 + NPTPLY(JB)                                              HBELT
      DO  20  K=K1,K2                                                   HBELT
      KNL = KNLO + K                                                    HBELT
      KI = NL(1,KNL)                                                    HBELT
C                                                                       HBELT
C     HERE K   IS INDEX OF POINTS IN PLAY ON EACH HARNESS               HBELT
C          KNL IS INDEX OF ALL POINTS IN PLAY                           HBELT
C          KI  IS INDEX OF ALL POINTS                                   HBELT
C                                                                       HBELT
      KS   = IABS(IBAR(1,KI))                                           HBELT
      IF  (KS.GT.100)  NTP = 1                                          HBELT
      IF  (KS.GT.100)  KS = MOD(KS,100)                                 HBELT
      KE = IBAR(2,KI)                                                   HBELT
```

```
      CALL DOT31 (D(1,1,KS),BAR(4,KI),T1)                              HBELT
      CALL DOT31 (D(1,1,KS),BAR(7,KI),T2)                              HBELT
      DO 11 J=1,3                                                      HBELT
      R(J) = V(J)                                                      HBELT
      V(J) = BAR(J+3,KI) + BAR(J+6,KI)                                 HBELT
      TR(J,K) = T1(J)                                                  HBELT
      ZR(J,K) = T1(J) + T2(J)                                          HBELT
      S (J,2) = S(J,1)                                                 HBELT
   11 S (J,1) = SEGLP(J,KS) + ZR(J,K)                                  HBELT
      CALL CROSS (WMEG(1,KS),V,T)                                      HBELT
      IF (KE.EQ.0) GO TO 12                                            HBELT
      CALL MAT31 (BD(7,KE),BAR(4,KI),T2)                               HBELT
      CALL DOT31 (D(1,1,KS),T2,T1)                                     HBELT
   12 DO 13 J=1,3                                                      HBELT
      T(J) = T(J) + BAR(J+12,KI)                                       HBELT
   13 E(J,3,K) = T1(J)                                                 HBELT
      CALL DOT31 (D(1,1,KS),T,V)                                       HBELT
      DO 14 J=1,3                                                      HBELT
   14 V(J) = V(J) + SEGLV(J,KS)                                        HBELT
      FB(K) = 0.0                                                      HBELT
      FP(K) = 0.0                                                      HBELT
      IF (K.EQ.K1) GO TO 20                                            HBELT
      DO 15 J=1,3                                                      HBELT
   15 U(J,K-1) = S(J,1) - S(J,2)                                       HBELT
      BL(K-1) = DSQRT(U(1,K-1)**2 + U(2,K-1)**2 + U(3,K-1)**2)         HBELT
      DO 16 J=1,3                                                      HBELT
   16 U(J,K-1) = U(J,K-1)/BL(K-1)                                      HBELT
      STRAIN = (BL(K-1)/BB(KNL-1)) - 1.0                               HBELT
      IF (STRAIN.LT.EPS(12)) STRAIN = 0.0                              MISDOT
      NT = NL(2,KNL)                                                   HBELT
      BLDOT = U(1,K-1)*(V(1)-R(1))                                     HBELT
     *        + U(2,K-1)*(V(2)-R(2))                                   HBELT
     *        + U(3,K-1)*(V(3)-R(3))                                   HBELT
      STRDOT = (BB(KNL-1)*BLDOT-BL(K-1)*BBDOT(KNL-1))/BB(KNL-1)**2     HBELT
      CALL FRCDFL (STRAIN,STRDOT,NT,0,FPK,ELOSS)                       HBELT
      CALL FRCDFL (STRAIN,STRDOT,NT,1,FBK,ELOSS)                       HBELT
      PTLOSS(1,K-1) = BB(KNL-1)*ELOSS                                  HBELT
      FP(K-1) = FPK                                                    HBELT
      FB(K-1) = FBK                                                    HBELT
      IF (IND.NE.0) GO TO 20                                           ENDPFX
      IF (K.NE.K1+1) GO TO 19                                          ENDPFX
      BSF(1,NBSF) = STRAIN                                             ENDPFX
      BSF(2,NBSF) = FBK                                                ENDPFX
   19 IF (K.NE.K2) GO TO 20                                            ENDPFX
      BSF(3,NBSF) = STRAIN                                             ENDPFX
      BSF(4,NBSF) = FBK                                                ENDPFX
   20 CONTINUE                                                         HBELT
C                                                                      HBELT
C     SECOND LOOP ON K                                                 HBELT
C     COMPUTE FCE(K),E1(K),E2(K),EDOT(K),FR(K),U1(KS),U2(KS)           HBELT
C     NEED    FB(K&K-1),U(K&K-1),ZR(K),E3(K)                           HBELT
C                                                                      HBELT
```

```
      DO  30  K=K1,K2                                                   HBELT
      KNL = KNL0 + K                                                    HBELT
      KI = NL(1,KNL)                                                    HBELT
      KS   = IABS(IBAR(1,KI))                                           HBELT
      IF  (KS.GT.100)  KS = MOD(KS,100)                                 HBELT
      DO  21  J=1,3                                                     HBELT
      FCE(J,K) = 0.0                                                    HBELT
      IF (K.NE.K2) FCE(J,K) = FB(K)*U(J,K)                              BUTLER1
   21 IF  (K.NE.K1)  FCE(J,K) = FCE(J,K) - FB(K-1)*U(J,K-1)             BUTLER1
      NT = IBAR(3,KI)                                                   HBELT
      NF = NTAB(NT+5)                                                   HBELT
      IF  (NF.EQ.0 .AND. IND.EQ.0)  GO TO 30                            HBELT
      IF  (IBAR(4,KI).EQ.0)  GO TO 22                                   HBELT
      CALL DOT31 (D(1,1,KS),BAR(10,KI),T1)                              HBELT
      GO TO 24                                                          HBELT
   22 DO  23  J=1,3                                                     HBELT
      T1(J) = 0.0                                                       HBELT
      IF  (K.NE.K2)  T1(J) = U(J,K)                                     HBELT
   23 IF  (K.NE.K1)  T1(J) = T1(J) + U(J,K-1)                           HBELT
   24 CALL CROSS (T1,E(1,3,K),E(1,1,K))                                 HBELT
      CALL CROSS (E(1,3,K),E(1,1,K),E(1,2,K))                           HBELT
      DO  25  J=1,3                                                     HBELT
      EDOT(J,K) = DSQRT(E(1,J,K)**2 + E(2,J,K)**2 + E(3,J,K)**2)        HBELT
      DO  25  I=1,3                                                     HBELT
   25 E(I,J,K) = E(I,J,K)/EDOT(J,K)                                     HBELT
      CALL DOT31 (E(1,1,K),FCE(1,K),FR(1,K))                            HBELT
   30 CONTINUE                                                          HBELT
   31 CONTINUE                                                          HBELT
      IF  (NTP.LE.0)  GO TO 41                                          HBELT
C                                                                       HBELT
C     SUM FCE,FR FOR TIE-POINTS                                         HBELT
C                                                                       HBELT
      KNL1 = KNL0 + 2                                                   HBELT
      KNL2 = KNL0 + K2                                                  HBELT
      DO  40  KNL=KNL1,KNL2                                             HBELT
      KI = NL(1,KNL)                                                    HBELT
      KS   = IABS(IBAR(1,KI))                                           HBELT
      IF  (KS.LT.100)  GO TO 40                                         HBELT
      KS1 = KS/100                                                      HBELT
      KH = KNL - KNL0                                                   HBELT
      MH = 0                                                            HBELT
      DO  38  JNL=KNL1,KNL                                              HBELT
      KI = NL(1,JNL-1)                                                  HBELT
      KS   = IABS(IBAR(1,KI))                                           HBELT
      IF  (KS.LT.100)  GO TO 38                                         HBELT
      KS2 = KS/100                                                      HBELT
      IF  (KS2.NE.KS1)  GO TO 38                                        HBELT
      JH = JNL-1 - KNL0                                                 HBELT
      IF  (MH.EQ.0)  MH = JH                                            HBELT
      DO  37  J=1,3                                                     HBELT
      IF  (MH.EQ.JH)  FCE(J,MH) = FCE(J,MH) + FCE(J,KH)                 HBELT
   37 FCE(J,JH) = FCE(J,MH)                                             HBELT
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```
      CALL DOT31 (E(1,1,JH),FCE(1,JH),FR(1,JH))                         HBELT
   38 CONTINUE                                                          HBELT
      IF  (MH.EQ.0)  GO TO 40                                           HBELT
      KI - NL(1,KNL)                                                    HBELT
      IBAR(1,KI) - -IABS(IBAR(1,KI))                                    HBELT
      DO  39  J-1,3                                                     HBELT
   39 FCE(J,KH) - FCE(J,MH)                                             HBELT
      CALL DOT31 (E(1,1,KH),FCE(1,KH),FR(1,KH))                         HBELT
   40 CONTINUE                                                          HBELT
C                                                                       HBELT
C     IF CALL IS FROM SUBROUTINE CONTCT,                                HBELT
C     ADD FORCES (FCE) MODIFIED BY FRICTION TO U1,U2 ARRAYS.            HBELT
C                                                                       HBELT
   41 IF  (IND.NE.0)  GO TO 52                                          HBELT
      K2 = 0                                                            HBELT
      DO  51  JB=J1,J2                                                  HBELT
      IF  (NPTPLY(JB).LE.0)  GO TO 51                                   HBELT
      K1 = K2 + 1                                                       HBELT
      K2 - K2 + NPTPLY(JB)                                              HBELT
      DO  50  K=K1,K2                                                   HBELT
      KNL - KNLO + K                                                    HBELT
      KI - NL(1,KNL)                                                    HBELT
      IF  (IBAR(1,KI).LT.0)  GO TO 50                                   HBELT
      KS - IBAR(1,KI)                                                   HBELT
      IF  (KS.GT.100)  KS - MOD(KS,100)                                 HBELT
      NT - IBAR(3,KI)                                                   HBELT
      NF - NTAB(NT+5)                                                   HBELT
      IF  (NF.EQ.0)  GO TO 43                                           HBELT
      DO  42  J=1,3                                                     HBELT
   42 T1(J) - FR(J,K)                                                   HBELT
      FR1 = TAB(NF+2)*DABS(T1(3))                                       HBELT
      FR2 = TAB(NF+4)*DABS(T1(3))                                       HBELT
      IF  (DABS(T1(1)).GT.FR1)  T1(1) = DSIGN(FR1,T1(1))                HBELT
      IF  (DABS(T1(2)).GT.FR2)  T1(2) = DSIGN(FR2,T1(2))                HBELT
      CALL MAT31 (E(1,1,K),T1,FCE(1,K))                                 HBELT
   43 CALL CROSS (ZR(1,K),FCE(1,K),T2)                                  HBELT
      CALL MAT31 (D(1,1,KS),T2,T1)                                      HBELT
      DO  44  J=1,3                                                     HBELT
      U1(J,KS) - U1(J,KS) + FCE(J,K)                                    HBELT
   44 U2(J,KS) - U2(J,KS) + T1(J)                                       HBELT
   50 CONTINUE                                                          HBELT
   51 CONTINUE                                                          HBELT
   52 KNLO = KNLO + K2                                                  HBELT
      CALL ELTIME (2,38)                                                HBELT
      RETURN                                                            HBELT
      END                                                               HBELT
```

```
      SUBROUTINE HBPLAY                                                 HBPLAY
C                                                  REV III.5 10/17/85EDGE
      IMPLICIT REAL*8 (A-H,O-Z)                                         HBPLAY
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           HBPLAY
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),HBPLAY
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       HBPLAY
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       HBPLAY
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          HBPLAY
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         HBPLAY
C     THIS COMMON/TEMPVS/ IS SHARED BY HPTURB, HBPLAY, HBELT AND HSETC. HBPLAY
      COMMON/TEMPVS/ B(3,3,3),S(3,3),T(3),R(3),V(3),T1(3),T2(3),        HBPLAY
     *               E(3,3,50),EDOT(3,50),FCE(3,50),FR(3,50),ZR(3,50).  HBPLAY
     *               TR(3,50),U(3,50),PTLOSS(2,50),BL(50),FB(50),FP(50),HBPLAY
     *               OLDBB(100),RHS(3,54),C(3,3,200),IJK(54,54)         HBPLAY
     *              ,DMMY(29942)                                        80386
      IF  (NHRNSS.LE.0)  GO TO 99                                       HBPLAY
C                                                                       HBPLAY
C     SAVE PREVIOUS NL,BB AND PLOSS ARRAYS.                             HBPLAY
C     USE IJK,OLDBB AND PTLOSS AS TEMP STORAGE.                         HBPLAY
C                                                                       HBPLAY
      DO  10  I=1,100                                                   HBPLAY
      IJK(I,1) = NL(1,I)                                                HBPLAY
      PTLOSS(I,1) = PLOSS(1,I)                                          HBPLAY
   10 OLDBB(I) = BB(I)                                                  HBPLAY
      JNL = 1                                                           HBPLAY
      J1 = 1                                                            HBPLAY
      K1 = 1                                                            HBPLAY
      LL = 0                                                            HBPLAY
      DO  90  NH=1,NHRNSS                                               HBPLAY
      IF  (NBLTPH(NH).LE.0)  GO TO 90                                   HBPLAY
      J2 = J1 + NBLTPH(NH) - 1                                          HBPLAY
      DO  80  NB=J1,J2                                                  HBPLAY
      L1 = LL                                                           HBPLAY
      IF  (NPTSPB(NB).LE.0)  GO TO 80                                   HBPLAY
      K2 = K1 + NPTSPB(NB) - 1                                          HBPLAY
      KB = 0                                                            HBPLAY
      DO  30  K=K1,K2                                                   HBPLAY
      KB = KB + 1                                                       HBPLAY
C                                                                       HBPLAY
C     HERE K IS INDEX OF ALL POINTS                                     HBPLAY
C         KB IS INDEX OF POINTS ON A SINGLE BELT                        HBPLAY
C         LL IS INDEX OF ALL POINTS IN PLAY                             HBPLAY
C         JB IS INDEX OF PREVIOUS POINT ON BELT IN PLAY                 HBPLAY
C                                                                       HBPLAY
      KS = IABS(IBAR(1,K))                                              HBPLAY
      IF  (KS.GT.100)  KS = MOD(KS,100)                                 HBPLAY
      CALL DOT31 (D(1,1,KS),BAR(4,K),T1)                                HBPLAY
      CALL DOT31 (D(1,1,KS),BAR(7,K),T2)                                HBPLAY
      DO  11  J=1,3                                                     HBPLAY
   11 U(J,KB) = SEGLP(J,KS) + T1(J) + T2(J)                             HBPLAY
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```
      IF  (K.EQ.K1)  GO TO 30                                         HBPLAY
      LL = LL + 1                                                     HBPLAY
   12 JJ = NL(1,LL)                                                   HBPLAY
      JB = JJ - K1 + 1                                                HBPLAY
      DSS = 0.0                                                       HBPLAY
      DO  13  J=1,3                                                   HBPLAY
      ZR(J,KB) = U(J,KB) - U(J,JB)                                    HBPLAY
   13 DSS = DSS + ZR(J,KB)**2                                         HBPLAY
      BL(LL) = DSQRT(DSS)                                             HBPLAY
      IF  (JJ.EQ.K1 .OR. IABS(IBAR(1,JJ)).GT.100)  GO TO 30           HBPLAY
      JS = IBAR(1,JJ)                                                 HBPLAY
      JE = IBAR(2,JJ)                                                 HBPLAY
      IF  (JE.LE.0)  GO TO 30                                         HBPLAY
      CALL MAT31 (BD(7,JE),BAR(4,JJ),T2)                              HBPLAY
      CALL DOT31 (D(1,1,JS),T2,R)                                     HBPLAY
      DPR = 0.0                                                       HBPLAY
      DO  17  J=1,3                                                   HBPLAY
   17 DPR = DPR + R(J)*(ZR(J,KB)/BL(LL) - ZR(J,JB)/BL(LL-1))          HBPLAY
      IF  (DPR.LT.0.0)  GO TO 30                                      HBPLAY
      LL = LL - 1                                                     HBPLAY
      GO TO 12                                                        HBPLAY
   30 NL(1,LL+1) = K                                                  HBPLAY
      L2 = L1 + 1                                                     HBPLAY
      LL = LL + 1                                                     HBPLAY
      L3 = LL-1                                                       HBPLAY
      DO  31  J=L2,LL                                                 HBPLAY
   31 NL(2,J) = NTHRNS(NB)                                            HBPLAY
      IF  (XLONG(NB).EQ.0.0)  GO TO 35                                HBPLAY
C                                                                     HBPLAY
C     FIRST TIME IN ROUTINE, SET INITIAL BB ARRAY.                    HBPLAY
C     INPUT XLONG MUST BE NON-ZERO TO TRIGGER THIS TEST.              HBPLAY
C                                                                     HBPLAY
      XLG = 0.0                                                       HBPLAY
      DO  32  J=L2,L3                                                 HBPLAY
   32 XLG = XLG + BL(J)                                               HBPLAY
      XLG = 1.0 + XLONG(NB)/XLG                                       HBPLAY
      DO  33  J=L2,L3                                                 HBPLAY
   33 BB(J) = XLG*BL(J)                                               HBPLAY
      XLONG(NB) = 0.0                                                 HBPLAY
      GO TO 52                                                        HBPLAY
C                                                                     HBPLAY
C     DETERMINE IF NEW NL ARRAY IS DIFFERENT FROM PREVIOUS NL ARRAY.  HBPLAY
C     IF SO, RECOMPUTE BB ELEMENTS FOR POINTS THAT ARE DIFFERENT.     HBPLAY
C                                                                     HBPLAY
   35 IF  (NL(1,L2).EQ.IJK(JNL,1))  GO TO 61                          HBPLAY
      WRITE (6,62)                                                    HBPLAY
   62 FORMAT ('0 LOGIC ERROR IN SUB HBPLAY. PROGRAM TERMINATED.')     HBPLAY
      STOP 42                                                         HBPLAY
   61 LTEST = 0                                                       HBPLAY
      M = L2                                                          HBPLAY
      N = JNL                                                         HBPLAY
   36 IF  (NL(1,M+1)-IJK(N+1,1))  39,37,41                            HBPLAY
```

```
   37  BB(M) = OLDBB(N)                                          HBPLAY
       PLOSS(1,M) = PTLOSS(N,1)                                  HBPLAY
   38  M = M+1                                                   HBPLAY
       N = N+1                                                   HBPLAY
       IF  (M-LL)  36,51,51                                      HBPLAY
C                                                                HBPLAY
C      POINT M+1 IS NEW.                                         HBPLAY
C                                                                HBPLAY
   39  MO = M                                                    HBPLAY
       NO = N                                                    HBPLAY
       LTEST = 1                                                 HBPLAY
   40  M = M+1                                                   HBPLAY
C                                                                CHGIII
C      MODIFY NEW POINT TO LIE IN BELT PLANE                     CHGIII
C                                                                CHGIII
       IP1 = N - 1                                               CHGIII
       IF  (N.GT.JNL)  GO TO 63                                  CHGIII
       IP1 = N                                                   CHGIII
C      (IS THIRD POINT AVAILABLE FROM OLD POINTS IN PLAY?)       CHGIII
       IF  (IJK(N+1,1).EQ.NL(1,LL))  GO TO 43                    CHGIII
   63  DO  64  I=1,3                                             CHGIII
       IP = IP1 + I - 1                                          CHGIII
C      (USE OLD POINTS IP = N-1,N,N+1 IF N > JNL                 CHGIII
C                  OR IP = N,N+1,N+2 IF N = JNL AND N+2 EXISTS)  CHGIII
       NI = IJK(IP,1)                                            CHGIII
       NSI= IABS(IBAR(1,NI))                                     NSFIX
       IF (NSI.GT.100) NSI = MOD(NSI,100)                        NSFIX
       CALL DOT31 (D(1,1,NSI),BAR(4,NI),T1)                      NSFIX
       CALL DOT31 (D(1,1,NSI),BAR(7,NI),T2)                      NSFIX
       DO  64  J=1,3                                             CHGIII
   64  S(J,I) = SEGLP(J,NSI)+ T1(J) + T2(J)                      NSFIX
       DO  65  J=1,3                                             CHGIII
       S(J,3) = S(J,3) - S(J,2)                                  CHGIII
   65  S(J,2) = S(J,2) - S(J,1)                                  CHGIII
C      (S(*,1) IS POINT P1 IN INERTIAL REFERENCE)                CHGIII
C      (S(*,2) IS VECTOR (P2-P1) IN INERTIAL REFERENCE)          CHGIII
C      (S(*,3) IS VECTOR (P3-P2) IN INERTIAL REFERENCE)          CHGIII
       CALL CROSS (S(1,3),S(1,2),T2)                             CHGIII
       ABST = DSQRT(T2(1)**2 + T2(2)**2 + T2(3)**2)              CHGIII
       DO  66  J=1,3                                             CHGIII
   66  T2(J) = T2(J)/ABST                                        CHGIII
C      (T2 IS T, THE NORMALIZED PLANE VECTOR IN INERTIAL REFERENCE)  CHGIII
       MI = NL(1,M)                                              CHGIII
       MS = IABS(IBAR(1,MI))                                     CHGIII
       IF (MS.GT.100)   MS = MOD(MS,100)                         CHGIII
       ME = IBAR(2,MI)                                           CHGIII
       CALL MAT31 (D(1,1,MS),T2,T1)                              CHGIII
C      (T1 IS T IN ELLIPSOID REFERENCE OF NEW POINT M)           CHGIII
       D1 = T2(1)*S(1,1) + T2(2)*S(2,1) + T2(3)*S(3,1)           CHGIII
       D2 = T1(1)*BAR(7,MI) + T1(2)*BAR(8,MI) + T1(3)*BAR(9,MI)  CHGIII
       D3 = T2(1)*SEGLP(1,MS) + T2(2)*SEGLP(2,MS) + T2(3)*SEGLP(3,MS)  CHGIII
       DD = D1 - D2 - D3                                         CHGIII
```

```
C     (DD IS D, THE DISTANCE OF ELLIPSOID CENTER TO PLANE)               CHGIII
      CALL MAT31 (BD(16,ME),T1,R)                                        CHGIII
      BX = DD/(T1(1)*R(1) + T1(2)*R(2) + T1(3)*R(3))                     CHGIII
      D4 = T1(1)*BAR(4,MI) + T1(2)*BAR(5,MI) + T1(3)*BAR(6,MI)           CHGIII
      DO  67  J=1,3                                                      CHGIII
      R(J) = BX*R(J)                                                     CHGIII
C     (R IS S, THE CENTER OF THE ELLIPSE)                                CHGIII
   67 V(J) = BAR(J+3,MI) + (DD-D4)*T1(J)                                 CHGIII
C     (BAR(J+3,MI) IS P, THE NEW POINT TO BE ADDED)                      CHGIII
C     (V IS Q, THE PROJECTION OF POINT P ONTO THE PLANE)                 CHGIII
      AX = DSQRT( (BX*DD-1.0) / (BX*DD-XDY(V,BD(7,ME),V)) )              CHGIII
      DO  68  J=1,3                                                      CHGIII
   68 BAR(J+3,MI) = R(J) + AX*(V(J)-R(J))                                CHGIII
C     (BAR(J+3,MI) IS R = S + A(Q - S), Q EXTENDED TO ELLIPSOID)         CHGIII
      GO TO 43                                                           HBPLAY
C                                                                        HBPLAY
C      POINT N+1 IS DROPPED.                                             HBPLAY
C                                                                        HBPLAY
   41 MO = M                                                             HBPLAY
      NO = N                                                             HBPLAY
      LTEST = 1                                                          HBPLAY
   42 N = N+1                                                            HBPLAY
   43 IF  (NL(1,M+1)-IJK(N+1,1))  40,44,42                               HBPLAY
C                                                                        HBPLAY
C     POINTS NO TO N+1 ARE BEING REPLACED WITH POINTS MO TO M+1.         HBPLAY
C                                                                        HBPLAY
   44 SUMBL = 0.0                                                        HBPLAY
      DO  45  J=MO,M                                                     HBPLAY
   45 SUMBL = SUMBL + BL(J)                                              HBPLAY
      SUMPL = 0.0                                                        HBPLAY
      SUMBB = 0.0                                                        HBPLAY
      DO  46  J=NO,N                                                     HBPLAY
      SUMPL = SUMPL + PTLOSS(J,1)                                        HBPLAY
   46 SUMBB = SUMBB + OLDBB(J)                                           HBPLAY
      RATPL = SUMPL/SUMBL                                                HBPLAY
      RATIO = SUMBB/SUMBL                                                HBPLAY
      DO  47  J=MO,M                                                     HBPLAY
      PLOSS(1,J) = RATPL*BL(J)                                           HBPLAY
   47 BB(J) = RATIO*BL(J)                                                HBPLAY
      GO TO 38                                                           HBPLAY
   51 JNL = N+1                                                          HBPLAY
      IF  (LTEST.EQ.0)  GO TO 79                                         HBPLAY
C                                                                        HBPLAY
C     PRINT NEW POINT ARRAY IF DIFFERENT.                                HBPLAY
C                                                                        HBPLAY
   52 NPTS = LL - L1                                                     HBPLAY
      USEC = 1000.0*TIME                                                 HBPLAY
      WRITE  (6,53)  USEC,NH,NB,NPTS,NTHRNS(NB)                          HBPLAY
   53 FORMAT ('0 HBPLAY TIME =',F10.3,' MSEC. NH,NB,NPTS NT=',4I6)       HBPLAY
      WRITE  (6,54)  (NL(1,J),J=L2,LL)                                   HBPLAY
   54 FORMAT ('  NL(1)=',15I8/(8X,15I8))                                 HBPLAY
      WRITE  (6,55)  (BB(J),J=L2,L3)                                     HBPLAY
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```
55  FORMAT ('  BB   =',6X,14F8.3/(6X,15F8.3))                    HBPLAY
79  K1 = K2 + 1                                                  HBPLAY
80  NPTPLY(NB) = LL - L1                                         HBPLAY
    J1 = J2 + 1                                                  HBPLAY
90  CONTINUE                                                     HBPLAY
99  RETURN                                                       HBPLAY
    END                                                          HBPLAY
```

```
      SUBROUTINE HEDING (LINES,LPP)                                     HEDING
C                                                 REV IV    02/01/88MISDOT
      IMPLICIT REAL*8 (A-H,O-Z)                                         HEDING
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           HEDING
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/JBARTZ/ MNPL(    30),MNBLT(    8),MNSEG(    30),MNBAG(    6), HEDING
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), HEDING
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               HEDING
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           HEDING
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       HEDING
     *               JOINT(30),CGS(30),JS(30)                           HEDING
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      HEDING
      LOGICAL*1 CGS,JS                                                  HEDING
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         HEDING
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         HEDING
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      COMMON/DAMPER/ APSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)HEDING
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       HEDING
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          HEDING
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         HEDING
C     NOTE: SUBROUTINES POSTPR & HEDING SHARE THIS COMMON/TEMPVS/.      HEDING
C     SEE COMMENT IN POSTPR ABOUT FIRST DIMENSION OF PLDATA.            HEDING
      REAL HEAD,PHED,BLANK,PLDATA,USEC,ZTTH,AHED,AHEAD,GHED,ZZZ         PLTINC
      COMMON/TEMPVS/ TDATA(14,65),HEAD(20),NOPL(150),MOPL(150),         CHGIII
     *     M1PL(150),PLDATA(97,20),USEC(45),ZZZ(1000,25),ZTTH(14,45,65) MISDOT
     *              ,IDMMY                                              80386
      LOGICAL   LOLD , LNEW                                             HEDING
      DIMENSION PHED(5),HEDJ(4,2),HEADJJ(4,2),HEADR(20)                 TTHKREF
      DATA HEDJ/8HIPIN  FL,8HEXURE  A,8HZIMUTH  ,8HTORSION ,            HEDING
     *        8HIEULER  ,8HPREC.  N,8HUTATION ,8H  SPIN  /              HEDING
      DIMENSION AHED(5,2),AHEAD(5,20),GHED(2)                           ACCEL
      DATA AHED/4H IN ,4H    ,4H REF,4HEREN,4HCE  ,                     ACCEL
     *         4H  AC,4HCELE,4HROME,4HTER ,4H    /                      ACCEL
      DATA GHED/4H(0G),4H(1G)/                                          ACCEL
      DATA BLANK/4H    /                                                HEDING
      DATA PHED/4HSPRF,4HPNL1,4HPNL2,4HPNL3,4HPNL4/                     HEDING
      NPRT4 = NPRT(4) + 4                                               HEDING
      IF  (NPRT4.LE.0 .OR. NPRT4.GT.8)  STOP 40                         HEDING
      GO TO  (11,11,82,12,12,11,11,12) , NPRT4                          HEDING
   11 LOLD = .FALSE.                                                    HEDING
      LNEW = .TRUE.                                                     HEDING
      GO TO 13                                                          HEDING
   12 LOLD = .TRUE.                                                     HEDING
      LNEW = .FALSE.                                                    HEDING
   13 MT = 20                                                           HEDING
      NLINES = MOD(LINES-1,LPP)+1                                       HEDING
      XPAGE = 0.01*FLOAT((LINES + LPP-1)/LPP)                           HEDING
C                                                                       HEDING
C     NOTE: MT WILL BE THE PAGE OR OUTPUT UNIT COUNTER                  HEDING
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C             NT WILL BE THE ACTUAL OUTPUT UNIT NUMBER                    HEDING
C             IT WILL BE THE INDEX TO THE DATA ARRAY                      HEDING
C             NLINES WILL BE THE NUMBER OF LINES TO BE PRINTED            HEDING
C                                                                         HEDING
C                                                                         HEDING
C       EVERY LPP LINES PRINT HEADINGS FOR 9 TYPES OF OUTPUT ABOVE.       WINDOP
C                                                                         HEDING
        DO 20 K=1,9                                                       WINDOP
        IF (NSG(K).LE.0) GO TO 20                                         HEDING
        KSG = NSG(K)                                                      HEDING
        IF (K.EQ.9) GO TO 455                                             WINDOP
        J3  = 3                                                           HEDING
        IF (K.EQ.7) J3 = 2                                                HEDING
        DO 19 J1=1,KSG,J3                                                 HEDING
        MT = MT + 1                                                       HEDING
        NT = MT                                                           HEDING
        IF  (LNEW)  NT = 6                                                HEDING
        IT = MT - 20                                                      HEDING
        PAGE = FLOAT(MT) + XPAGE                                          HEDING
C       P & E PRINTER CARRIAGE CONTROL                                    PECONV
C       CALL CARCON(NT,1)                                                 80386
        IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                         PAGE
        IF (NT.NE.6) WRITE(NT,121) DATE                                   PAGE
        IF (NT.EQ.6) NPG=NPG+1                                            PAGE
        WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                           PAGE
        IF (K.EQ.1) WRITE (NT,22)                                         TTHKREF
        IF (K.EQ.2) WRITE (NT,23) UNITL,UNITT                             TTHKREF
        IF (K.EQ.3) WRITE (NT,24) UNITL                                   TTHKREF
        IF (K.EQ.4) WRITE (NT,25) UNITT                                   TTHKREF
        IF (K.EQ.5) WRITE (NT,26) UNITT                                   TTHKREF
        IF (K.EQ.6) WRITE (NT,27)                                         TTHKREF
        IF (K.EQ.7) WRITE (NT,28)                                         HEDING
        IF (K.EQ.8) WRITE(NT,200) UNITM                                   TTHKREF
        J2 = MINO(J1+J3-1,KSG)                                            HEDING
        DO 14 J=J1,J2                                                     HEDING
        KK = MSG(J,K)                                                     HEDING
        HEAD(J) = SEG(IABS(KK))                                           ACCEL
        IF ((K.LT.7).OR.(K.EQ.8)) GO TO 214                               TTHKREF
        KK = IABS(KK)                                                     HEDING
        HEAD(J) = JOINT(KK)                                               HEDING
        JJ2 = J-J1+1                                                      HEDING
        K2 = 1                                                            HEDING
        IF (MSG(J,K).LT.0) K2 = 2                                         HEDING
        DO  35  K1=1,4                                                    HEDING
     35 HEADJJ(K1,JJ2) = HEDJ(K1,K2)                                      HEDING
        GO TO 14                                                          TTHKREF
    214 IF (MSG(J,K).LT.0) GOTO 302                                       ACCEL
        IF (KREF(J,K).EQ.0) HEADR(J)=SEG(NVEH)                            ACCEL
        IF (K.EQ.8) HEADR(J)=SEG(NGRND)                                   TTHKREF
        IF (K.EQ.1 .OR. K.EQ.4) HEADR(J)=SEG(KK)                          TTHKREF
        IF (KREF(J,K).NE.0) HEADR(J)=SEG(KREF(J,K))                       TTHKREF
        DO 301 II=1,5                                                     ACCEL
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  301 AHEAD(II,J)=AHED(II,1)                                              ACCEL
      AHEAD(2,J)=HEADR(J)                                                 ACCEL
      GOTO 14                                                             ACCEL
  302 HEADR(J)=SEG(IABS(KK))                                              ACCEL
      DO 303 II=1,4                                                       ACCEL
  303 AHEAD(II,J)=AHED(II,2)                                              ACCEL
      AHEAD(5,J)=GHED(KREF(J,K)+1)                                        ACCEL
   14 CONTINUE                                                            HEDING
      IF (K.LE.3) WRITE (NT,29) (BLANK,(XSG(I,J,K),I=1,3),J=J1,J2)       HEDING
      IF (K.LE.6) WRITE (NT,30) (BLANK,MSG(J,K),HEAD(J),J=J1,J2)         HEDING
      IF (K.EQ.8) WRITE (NT,30) (BLANK,MSG(J,K),HEAD(J),J=J1,J2)         WINDOP
      IF (K.LE.6 .OR. K.EQ.8) WRITE (NT,230)                              ACCEL
     *                         (BLANK,(AHEAD(II,J),II=1,5),J=J1,J2)       ACCEL
      IF ((K.LE.5).OR.(K.EQ.8)) WRITE (NT,31) (BLANK,J=J1,J2)             WINDOP
      IF (K.EQ.6) WRITE (NT,32) (BLANK,J=J1,J2)                           HEDING
      IF ((K.LT.7).OR.(K.EQ.8)) GOTO 15                                   WINDOP
      WRITE (NT,33) (BLANK,MSG(J,K),HEAD(J),J=J1,J2)                      HEDING
      WRITE (NT,36) (BLANK,UNITL,UNITM,J=J1,J2)                           HEDING
      WRITE (NT,37) (BLANK,(HEADJJ(K1,J),K1=1,4),J=1,JJ2)                 HEDING
   15 WRITE (NT,38)                                                       HEDING
      IF  (.NOT.LNEW)  GO TO 19                                           HEDING
      IF  (K.EQ.7)  GO TO 17                                              HEDING
      JJ = 4*(J2-J1+1)                                                    HEDING
      DO  16  I=1,NLINES                                                  HEDING
   16 WRITE (NT,39)  USEC(I),(ZTTH(J,I,IT),J=1,JJ)                        HEDING
      GO TO 19                                                            HEDING
   17 JJ = 7*(J2-J1+1)                                                    HEDING
      DO  18  I=1,NLINES                                                  HEDING
   18 WRITE (NT,40)  USEC(I),(ZTTH(J,I,IT),J=1,JJ)                        HEDING
   19 CONTINUE                                                            HEDING
      GO TO 20                                                            CHGIII
C                                                                         CHGIII
C     PRINT HEADING FOR JOINT FORCES & TORQUES                            CHGIII
C                                                                         CHGIII
  455 CONTINUE                                                            CHGIII
      DO 860 II=1,KSG                                                     CHGIII
      IF(KREF(II,K).EQ.0) KRF = NVEH                                      TTHKREF
      IF(KREF(II,K).NE.0) KRF = KREF(II,K)                                TTHKREF
      JRF = MSG(II,9)                                                     WINDOP
      MT = MT + 1                                                         CHGIII
      NT = MT                                                             CHGIII
      IF (LNEW) NT = 6                                                    CHGIII
C     P & E CARRIAGE CONTROL                                              PECONV
C     CALL CARCON(NT,1)                                                   80386
      IT = MT - 20                                                        CHGIII
      PAGE = FLOAT (MT) + XPAGE                                           CHGIII
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                           PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                     PAGE
      IF (NT.EQ.6) NPG=NPG+1                                              PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                             PAGE
      WRITE (NT,850) JOINT(JRF),SEG(JRF+1),SEG(KRF)                       OUT385
      WRITE (NT,38)                                                       CHGIII
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      WRITE (NT,851) UNITM,UNITL,UNITM                                  CHGIII
      WRITE (NT,852)                                                    CHGIII
      WRITE (NT,38)                                                     CHGIII
      IF (.NOT.LNEW) GO TO 857                                          CHGIII
      DO 858  JK=1,NLINES                                               CHGIII
      WRITE (NT,856) USEC(JK),(ZTTH(J,JK,IT),J=1,6)                     CHGIII
  858 CONTINUE                                                          CHGIII
  857 CONTINUE                                                          CHGIII
  850 FORMAT(' '/47X,                                                   TTHKREF
     * A4,' JOINT FORCES & TORQUES ON ',A4,' IN ',A4,' REFERENCE')      OUT385
  851 FORMAT(4X,4HTIME,7X,13HJOINT FORCE (,A4,7H 10**2),10X,            CHGIII
     *14HJOINT TORQUE (,A4,1H-,A4,7H 10**2))                            CHGIII
  852 FORMAT(3X,6H(MSEC),8X,1HX,8X,1HY,8X,1HZ,14X,1HX,11X,1HY,11X,1HZ)  CHGIII
  856 FORMAT(F9.3,3X,3F9.3,3X,3(2X,D10.3))                              CHGIII
  860 CONTINUE                                                          CHGIII
   20 CONTINUE                                                          HEDING
  121 FORMAT('1',18X,'DATE:',3X,4A4,80X,'PAGE',I5)                      PAGE
   21 FORMAT(8X,'RUN DESCRIPTION:',3X,20A4/27X,20A4,'PAGE:',F6.2/       PAGE
     *       3X,'VEHICLE DECELERATION:',3X,20A4/                        HEDING
     *       11X,'CRASH VICTIM:',3X,5A4 )                               HEDING
   22 FORMAT(' '47X,                                                    TTHKREF
     * 'POINT TOTAL ACCELERATION (G''S)'/)                              TTHKREF
   23 FORMAT(' '47X,                                                    TTHKREF
     *'POINT REL. VELOCITY (',A4,'/',A4,')'/)                           TTHKREF
   24 FORMAT(' '47X,                                                    TTHKREF
     *'POINT REL. LINEAR DISPLACEMENT (',A4,')'/)                       TTHKREF
   25 FORMAT(' '/47X,                                                   TTHKREF
     *'SEGMENT ANGULAR ACCELERATION (REV/',A4,'**2)'/)                  TTHKREF
   26 FORMAT(' '/47X,                                                   TTHKREF
     *'SEGMENT REL. ANGULAR VELOCITY (REV/',A4,')'/)                    TTHKREF
   27 FORMAT(' '/47X,                                                   TTHKREF
     * 'SEGMENT REL. ANGULAR DISPLACEMENT (DEG)'/)                      TTHKREF
   28 FORMAT(' '/47X,'JOINT PARAMETERS'/)                               TTHKREF
  200 FORMAT(' '/47X,'SEGMENT WIND FORCE (',A4,')'/)                    TTHKREF
   29 FORMAT(9X,3(A4,3X,'POINT (',F6.2,',',F6.2,',',F6.2,') ON ') )     HEDING
   30 FORMAT('          ',3(A4,9X,'SEGMENT NO.',I3,' - ',A4,5X)   )     TTHKREF
  230 FORMAT('    TIME ',3(A4,9X,5A4,6X))                               ACCEL
   31 FORMAT('   (MSEC)',3(A4,5X,'X',8X,'Y',8X,'Z',7X,'RES',1X)  )      HEDING
   32 FORMAT('   (MSEC)',3(A4,4X,'YAW',5X,'PITCH',5X,'ROLL',5X,'RES ') )HEDING
   33 FORMAT(9X,2(A1,21X,'JOINT NO.',I3,' - ',A4,20X)  )                HEDING
   36 FORMAT('    TIME ',2(A1,'STATE',5X,'JOINT ANGLES (DEG)',8X,       HEDING
     *                     'TOTAL TORQUE (',2A4,') ') )                 HEDING
   37 FORMAT('   (MSEC)',2(A1,4A8,4X,'SPRING  VISCOUS    RES. ') )      HEDING
   38 FORMAT(1X)                                                        HEDING
   39 FORMAT(F9.3,3(3X,4F9.3) )                                         HEDING
   40 FORMAT(F9.3,2(F5.0,3F9.3,2X,3F9.3))                               HEDING
C                                                                       ATBIII
C     PRINT BODY PROPERTIES CONTROLLED BY H.10 CARDS                    WINDOP
C                                                                       ATBIII
      IF (MCG.EQ.0) GO TO 131                                           ATBIII
      DO 130 NCG=1,MCG                                                  ATBIII
      MT = MT +1                                                        ATBIII
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      NT = MT                                                          ATBIII
      IF (LNEW) NT = 6                                                 ATBIII
C     P & E CARRIAGE CONTROL                                           PECONV
C     CALL CARCON(NT,1)                                                80386
      IT = MT - 20                                                     ATBIII
      PAGE = FLOAT(MT) + XPAGE                                         ATBIII
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                        PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                  PAGE
      IF (NT.EQ.6) NPG=NPG+1                                           PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                          PAGE
      M = MCGIN(1,NCG)                                                 ATBIII
      WRITE (NT,132) M,SEG(M)                                          ATBIII
      N = MCGIN(2,NCG)                                                 ATBIII
      WRITE (NT,133) (MCGIN(I+2,NCG),I=1,N)                            ATBIII
      WRITE (NT,38)                                                    ATBIII
      WRITE (NT,134) UNITL,UNITM,UNITT,UNITL,UNITM,UNITT,UNITM,UNITL   KINETIC
      WRITE (NT,38)                                                    ATBIII
      IF (.NOT.LNEW) GO TO 130                                         ATBIII
      DO 129 I=1,NLINES                                                ATBIII
  129 WRITE (NT,135) USEC(I),(ZTTH(J,I,IT),J=1,12)                     KINETIC
  130 CONTINUE                                                         ATBIII
  131 CONTINUE                                                         ATBIII
  132 FORMAT(' ',47X,39HBODY PROPERTIES - REFERENCE SEGMENT NO.,       TTHKREF
     *       I3,2H (,A4,1H) )                                          ATBIII
  133 FORMAT(15X,21HINCLUDED SEGMENT NOS:,20I3)                        ATBIII
  134 FORMAT(14X,17HCENTER OF GRAVITY,13X,15HLINEAR MOMENTUM,17X,      KINETIC
     *      16HANGULAR MOMENTUM,18X,14HKINETIC ENERGY/                 KINETIC
     *      4X,4HTIME,11X,1H(,A4,1H),21X,1H(,A4,1H-,A4,1H),19X,        KINETIC
     *      1H(,A4,1H-,A4,1H-,A4,1H),20X,1H(,A4,1H-,A4,1H)/            MISC
     *      3X,6H(MSEC),5X,1HX,7X,1HY,7X,1HZ,                          KINETIC
     *      2(10X,1HX,10X,1HY,10X,1HZ),6X,6HLINEAR,5X,                 KINETIC
     *      7HANGULAR,5X,5HTOTAL)                                      KINETIC
  135 FORMAT(F9.3,3F8.3,9(1X,D10.3))                                   KINETIC
C                                                                      HEDING
C     PLANE FORCES HEADINGS                                            HEDING
C                                                                      HEDING
      MPSF = 0                                                         HEDING
      IF (NPL.EQ.0) GO TO 52                                           HEDING
      IF (NPRT(18).EQ.1.OR.NPRT(18).EQ.7) GO TO 52                     VARTTH
      IF (NPRT(18).EQ.10.OR.NPRT(18).EQ.11) GO TO 52                   VARTTH
      IF (NPRT(18).GE.14) GO TO 52                                     VARTTH
      DO  42  J=1,NPL                                                  HEDING
      IF (MNPL(J).EQ.0) GO TO 42                                       HEDING
      KPL = MNPL(J)                                                    HEDING
      DO 41 I=1,KPL                                                    HEDING
      MPSF = MPSF+1                                                    HEDING
      NOPL(MPSF) = J                                                   HEDING
      IF (MPL(3,I,J).LT.0) M1PL(MPSF) = MPL(2,I,J)                     CHGIII
      IF (MPL(3,I,J).GE.0) M1PL(MPSF) = MPL(1,I,J)                     CHGIII
   41 MOPL(MPSF) = MPL(2,I,J)                                          HEDING
   42 CONTINUE                                                         HEDING
      IF (MPSF.EQ.0) GO TO 52                                          HEDING
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      DO 44 J1=1,MPSF,2                                                  HEDING
      J2 = MINO(J1+1,MPSF)                                               HEDING
      MT = MT + 1                                                        HEDING
      NT = MT                                                            HEDING
      IF  (LNEW)  NT = 6                                                 HEDING
C     P & E CARRIAGE CONTROL                                             PECONV
C     CALL CARCON(NT,1)                                                  80386
      IT = MT - 20                                                       HEDING
      PAGE = FLOAT(MT) + XPAGE                                           HEDING
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                          PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                    PAGE
      IF (NT.EQ.6) NPG=NPG+1                                             PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                            PAGE
      WRITE (NT,45)                                                      HEDING
      N1 = NOPL(J1)                                                      HEDING
      N2 = NOPL(J2)                                                      HEDING
      M1 = MOPL(J1)                                                      HEDING
      M2 = MOPL(J2)                                                      HEDING
      MM1 = M1PL(J1)                                                     CHGIII
      MM2 = M1PL(J2)                                                     CHGIII
      IF  (J1.EQ.J2)  WRITE  (NT,46)                                     HEDING
     *               BLANK,N1,( PLTTL(I,N1),I=1,5),M1,SEG(M1)            HEDING
      IF  (J1.NE.J2)  WRITE  (NT,46)                                     HEDING
     *               BLANK,N1,( PLTTL(I,N1),I=1,5),M1,SEG(M1),           HEDING
     *               BLANK,N2,( PLTTL(I,N2),I=1,5),M2,SEG(M2)            HEDING
      WRITE (NT,47) (BLANK,UNITL,J=J1,J2)                                HEDING
      IF (J1.EQ.J2) WRITE (NT,48) BLANK,SEG(MM1)                         CHGIII
      IF (J1.NE.J2) WRITE (NT,448) BLANK,SEG(MM1),BLANK,SEG(MM2)         CHGIII
      WRITE (NT,49) (BLANK,UNITL,UNITM,UNITM,UNITM,J=J1,J2)              HEDING
      WRITE (NT,38)                                                      HEDING
      IF  (.NOT.LNEW)  GO TO 44                                          HEDING
      JJ = 7*(J2-J1+1)                                                   HEDING
      DO  43  I=1,NLINES                                                 HEDING
   43 WRITE (NT,50)  USEC(I),(ZTTH(J,I,IT),J=1,JJ)                       HEDING
   44 CONTINUE                                                           HEDING
   45 FORMAT(27X,'CONTACT FORCES - SEGMENT PANELS VS. SEGMENTS' )        CHGIII
   46 FORMAT(' '/8X,2(A4,'  PANEL',I3,' (',5A4,') VS. SEGMENT',I3,       HEDING
     *          ' (',A4,') ') )                                          HEDING
   47 FORMAT(' ',8X,A4,'DEFL-  NORMAL  FRICTION RESULTANT  CONTACT LOCATHEDING
     *ION (',A4,')',A2,'DEFL-  NORMAL  FRICTION RESULTANT  CONTACT LOCATHEDING
     *ION (',A4,')')                                                     HEDING
   48 FORMAT('    TIME',A4,'ECTION   FORCE    FORCE    FORCE      (',A4 CHGIII
     *,' REFERENCE)'  )                                                  CHGIII
  448 FORMAT('    TIME',A4,'ECTION   FORCE    FORCE    FORCE      (',A4 CHGIII
     *,' REFERENCE)',2X,A4,'ECTION   FORCE    FORCE    FORCE      (',A4 CHGIII
     *,' REFERENCE)'  )                                                  CHGIII
   49 FORMAT('   (MSEC)',2(A3,'(',A4,')',2X,'(',A4,')',4X,'(',A4,')',3X,HEDING
     *       '(',A4,',      X        Y        Z  ') )                    HEDING
   50 FORMAT(F9.3,2(F9.3,3F9.2,3F8.3) )                                  HEDING
   51 FORMAT(3X,'(MSEC)',4(A1,9X,'X',8X,'Y',8X,'Z',1X))                  HEDING
C                                                                        HEDING
C     BELT FORCES HEADINGS                                               HEDING
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C                                                                      HEDING
   52 MBSF = 0                                                         HEDING
      IF (NPRT(18).EQ.2.OR.NPRT(18).GE.13) GO TO 83                    VARTTH
      IF (NPRT(18).GE.7.AND.NPRT(18).LE.9) GO TO 83                    VARTTH
      IF  (NBLT.EQ.0)  GO TO 83                                        HEDING
      DO  54  J=1,NBLT                                                 HEDING
      IF (MNBLT(J).EQ.0) GO TO 54                                      HEDING
      MBSF = MBSF+1                                                    HEDING
      NOPL(MBSF) = J                                                   HEDING
      MOPL(MBSF) = MBLT(2,1,J)                                         HEDING
   54 CONTINUE                                                         HEDING
      IF  (MBSF.EQ.0)  GO TO 83                                        HEDING
      DO 56 J1=1,MBSF,2                                                HEDING
      J2 = MINO(J1+1,MBSF)                                             HEDING
      MT = MT + 1                                                      HEDING
      NT = MT                                                          HEDING
      IF  (LNEW)  NT = 6                                               HEDING
C     P & E CARRIAGE CONTROL                                           PECONV
C     CALL CARCON(NT,1)                                                80386
      IT = MT - 20                                                     HEDING
      PAGE = FLOAT(MT) + XPAGE                                         HEDING
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                        PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                  PAGE
      IF (NT.EQ.6) NPG=NPG+1                                           PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                          PAGE
      WRITE (NT,57)                                                    HEDING
      N1 = NOPL(J1)                                                    HEDING
      N2 = NOPL(J2)                                                    HEDING
      M1 = MOPL(J1)                                                    HEDING
      M2 = MOPL(J2)                                                    HEDING
      IF  (J1.EQ.J2)  WRITE  (NT,58)                                   HEDING
     *               BLANK,N1,(BLTTTL(I,N1),I=1,5),M1,SEG(M1)          HEDING
      IF  (J1.NE.J2)  WRITE  (NT,58)                                   HEDING
     *               BLANK,N1,(BLTTTL(I,N1),I=1,5),M1,SEG(M1),         HEDING
     *               BLANK,N2,(BLTTTL(I,N2),I=1,5),M2,SEG(M2)          HEDING
      WRITE (NT,59) (BLANK,J=J1,J2)                                    HEDING
      WRITE (NT,60) (BLANK,J=J1,J2)                                    HEDING
      WRITE (NT,61) (BLANK,UNITL,UNITL,UNITM,UNITL,UNITL,UNITM,J=J1,J2) HEDING
      WRITE (NT,38)                                                    HEDING
      IF  (.NOT.LNEW)  GO TO 56                                        HEDING
      JJ = 4*(J2-J1+1)                                                 HEDING
      DO  55  I=1,NLINES                                               HEDING
   55 WRITE (NT,62)  USEC(I),(ZTTH(J,I,IT),J=1,JJ)                     HEDING
   56 CONTINUE                                                         HEDING
   57 FORMAT('0',26X,'CONTACT FORCES - BELTS VS. SEGMENTS')            HEDING
   58 FORMAT(' ',7X,2(A4,'   BELT',I3,' (',5A4,') VS. SEGMENT',I3,      HEDING
     *          ' (',A4,') ') )                                        HEDING
   59 FORMAT(' ',2X,2(A4,11X,'ANCHOR  POINT  A',14X,'ANCHOR  POINT  B'))HEDING
   60 FORMAT(4X,'TIME',2(A4,5X,'STRAIN',7X,'FORCE',12X,                HEDING
     *                         'STRAIN',7X,'FORCE', 3X) )              HEDING
   61 FORMAT(3X,'(MSEC)',2(A4,2X,'(',A4,'/',A4,')',4X,'(',A4,')',9X,   HEDING
     *                           '(',A4,'/',A4,')',4X,'(',A4,')',3X) ) HEDING
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   62 FORMAT(F9.3,4(F15.6,F12.2,3X) )                                    HEDING
C                                                                        HEDING
C     HARNESS BELT ENDPOINTS FORCES HEADINGS                             HEDING
C                                                                        HEDING
   83 IF  (NHRNSS.LE.0)  GO TO 91                                        HEDING
      MBSF = 0                                                           HEDING
      IF (NPRT(18).EQ.3.OR.NPRT(18).EQ.11) GO TO 91                      VARTTH
      IF (NPRT(18).EQ.9.OR.NPRT(18).EQ.8) GO TO 91                       VARTTH
      IF (NPRT(18).EQ.13.OR.NPRT(18).EQ.14) GO TO 91                     VARTTH
      IF (NPRT(18).GE.16) GO TO 91                                       VARTTH
      J1 = 1                                                             HEDING
      K1 = 1                                                             HEDING
      DO  85  I=1,NHRNSS                                                 HEDING
      IF  (NBLTPH(I).LE.0)  GO TO 85                                     HEDING
      J2 = J1 + NBLTPH(I) - 1                                            HEDING
      DO  84  J=J1,J2                                                    HEDING
      MBSF = MBSF + 1                                                    HEDING
      IF  (NPTSPB(J).LE.0)  GO TO 84                                     HEDING
      K2 = K1 + NPTSPB(J) - 1                                            HEDING
      NOPL(2*MBSF-1) = J                                                 HEDING
      NOPL(2*MBSF  ) = I                                                 HEDING
      MOPL(2*MBSF-1) = K1                                                HEDING
      MOPL(2*MBSF  ) = K2                                                HEDING
      K1 = K2 + 1                                                        HEDING
   84 CONTINUE                                                           HEDING
      J1 = J2 + 1                                                        HEDING
   85 CONTINUE                                                           HEDING
      DO  87  J1=1,MBSF,2                                                HEDING
      J2 = MIN0(J1+1,MBSF)                                               HEDING
      MT = MT + 1                                                        HEDING
      NT = MT                                                            HEDING
      IF  (LNEW)  NT = 6                                                 HEDING
C     P & E CARRIAGE CONTROL                                             PECONV
C     CALL CARCON(NT,1)                                                  80386
      IT = MT - 20                                                       HEDING
      PAGE = FLOAT(MT) + XPAGE                                           HEDING
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                          PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                    PAGE
      IF (NT.EQ.6) NPG=NPG+1                                             PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                            PAGE
      WRITE (NT,88)                                                      HEDING
      WRITE (NT,89) (BLANK,NOPL(2*J-1),NOPL(2*J),J=J1,J2)                HEDING
      WRITE (NT,90) (BLANK,MOPL(2*J-1),MOPL(2*J),J=J1,J2)                HEDING
      WRITE (NT,60) (BLANK,J=J1,J2)                                      HEDING
      WRITE (NT,61) (BLANK,UNITL,UNITL,UNITM,UNITL,UNITL,UNITM,J=J1,J2) HEDING
      WRITE (NT,38)                                                      HEDING
      IF  (.NOT.LNEW)  GO TO 87                                          HEDING
      JJ = 4*(J2-J1+1)                                                   HEDING
      DO  86  I=1,NLINES                                                 HEDING
   86 WRITE (NT,62)  USEC(I),(ZTTH(J,I,IT),J=1,JJ)                       HEDING
   87 CONTINUE                                                           HEDING
   88 FORMAT('0',26X,'HARNESS SYSTEM BELT ENDPOINT FORCES')              HEDING
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   89 FORMAT(9X,2(A4,11X,'BELT NO.',I4,' OF HARNESS NO.',I3,15X))      HEDING
   90 FORMAT(9X,2(A4,6X,'POINT NO.',I5,16X,'POINT NO.',I5,6X))         HEDING
C                                                                      HEDING
C     SPRING DAMPER FORCES HEADINGS                                    HEDING
C                                                                      HEDING
   91 IF  (NSD.LE.0)  GO TO 63                                         HEDING
      IF (NPRT(18).EQ.4.OR NPRT(18).EQ.9) GO TO 63                     VARTTH
      IF (NPRT(18).GE.12) GO TO 63                                     VARTTH
      DO  94  J1=1,NSD,4                                               HEDING
      J2 = MINO(J1+3,NSD)                                              HEDING
      MT = MT + 1                                                      HEDING
      NT = MT                                                          HEDING
      IF  (LNEW)  NT = 6                                               HEDING
C     P & E CARRIAGE CONTROL                                           PECONV
C     CALL CARCON(NT,1)                                                80386
      IT = MT - 20                                                     HEDING
      PAGE = FLOAT(MT) + XPAGE                                         HEDING
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                        PAGE
      IF (NT.NE 6) WRITE(NT,121) DATE                                  PAGE
      IF (NT.EQ.6) NPG=NPG+1                                           PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                          PAGE
      WRITE (NT,95) (BLANK,J,J=J1,J2)                                  HEDING
      DO  92  J=J1,J2                                                  HEDING
      M1 = MSDM(J)                                                     HEDING
      N1 = MSDN(J)                                                     HEDING
C     POSSIBLE OVERFLOW INTO NOPL ARRAY IS INTENTIONAL.                HEDING
      HEAD(2*J-1) = SEG(M1)                                            HEDING
   92 HEAD(2*J  ) = SEG(N1)                                            HEDING
      WRITE (NT,96)(BLANK,MSDM(J),HEAD(2*J-1),MSDN(J),HEAD(2*J),J=J1,J2)HEDING
      WRITE (NT,97) (BLANK,J=J1,J2)                                    HEDING
      WRITE (NT,98) (BLANK,UNITL,UNITM,J=J1,J2)                        HEDING
      WRITE (NT,38)                                                    HEDING
      IF  (.NOT.LNEW)  GO TO 94                                        HEDING
      JJ = 2*(J2-J1+1)                                                 HEDING
      DO  93  I=1,NLINES                                               HEDING
   93 WRITE (NT,99)  USEC(I),(ZTTH(J,I,IT),J=1,JJ)                     HEDING
   94 CONTINUE                                                         HEDING
   95 FORMAT('0',26X,'SPRING DAMPER FORCES'/                           HEDING
     *        9X,4(A3,3X,'SPRING DAMPER NO.',I3,4X))                   HEDING
   96 FORMAT(9X,4(A3,'SEG',I3,'(',A4,') - SEG',I3,'(',A4,')'))         HEDING
   97 FORMAT(4X,'TIME',1X,4(A3,5X,'LENGTH',7X,'FORCE',4X))             HEDING
   98 FORMAT(3X,'(MSEC)',4(A3,5X,'(',A4,')',6X,'(',A4,')',4X))         HEDING
   99 FORMAT (F9.3,4(F14.3,F12.2,4X))                                  HEDING
C                                                                      HEDING
C     SEGMENT FORCES HEADINGS                                          HEDING
C                                                                      HEDING
   63 MSSF = 0                                                         HEDING
      IF (NPRT(18).EQ.5.OR.NPRT(18).EQ.13) GO TO 161                   VARTTH
      IF (NPRT(18).EQ.10.OR.NPRT(18).EQ.11) GO TO 161                  VARTTH
      IF (NPRT(18).GE.15) GO TO 161                                    VARTTH
      DO  65  J=1,NSEG                                                 HEDING
      IF (MNSEG(J).EQ.0) GO TO 65                                      HEDING
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      LSEG = MNSEG(J)                                                 HEDING
      DO 64  I=1,LSEG                                                 HEDING
      MSSF = MSSF+1                                                   HEDING
      NOPL(MSSF) = J                                                  HEDING
   64 MOPL(MSSF) = MSEG(2,I,J)                                        HEDING
   65 CONTINUE                                                        HEDING
      IF (MSSF.EQ.0) GO TO 70                                         HEDING
      DO 67 J=1,MSSF                                                  HEDING
      MT = MT + 1                                                     HEDING
      NT = MT                                                         HEDING
      IF  (LNEW)  NT = 6                                              HEDING
C     P & E CARRIAGE CONTROL                                          PECONV
C     CALL CARCON(NT,1)                                               80386
      IT = MT - 20                                                    HEDING
      PAGE = FLOAT(MT) + XPAGE                                        HEDING
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                       PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                 PAGE
      IF (NT.EQ.6) NPG=NPG+1                                          PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                         PAGE
      N1 = NOPL(J)                                                    HEDING
      M1 = MOPL(J)                                                    HEDING
      WRITE (NT,68) N1,SEG(N1),M1,SEG(M1),UNITL,N1,M1                 HEDING
     *               ,UNITL,UNITM,UNITM,UNITM                         HEDING
      IF  (.NOT.LNEW)  GO TO 67                                       HEDING
      DO  66  I=1,NLINES                                              HEDING
   66 WRITE (NT, 69)  USEC(I),(ZTTH(JJ,I,IT),JJ=1,10)                 HEDING
   67 CONTINUE                                                        HEDING
   68 FORMAT('0',26X,'CONTACT FORCES - SEGMENT NO.',I3,' (',A4,       HEDING
     *                            ') VS. SEGMENT NO.',I3,' (',A4,')'//  HEDING
     *        13X,'DEFL-  NORMAL  FRICTION RESULTANT',                HEDING
     *        14X,'CONTACT LOCATION (',A4,')'/                        HEDING
     *        4X,'TIME    ECTION',3(3X,'FORCE',1X),                   HEDING
     *        2('  SEG.',I3,' LOCAL REFERENCE ')/                     HEDING
     *        3X,'(MSEC)',3X,'(',A4,')', 3(3X,'(',A4,')'),            HEDING
     *        2(5X,'X',7X,'Y',7X,'Z',4X)/1X)                          HEDING
   69 FORMAT(2F9.3,3F9.2,3F8.3,2X,3F8.3)                              HEDING
  161 CONTINUE                                                        VARTTH
C                                                                     HEDING
C     AIRBAG FORCES HEAD!                                             HEDING
C                                                                     HEDING
   70 IF (NBAG.EQ.0) GO TO 82                                         HEDING
      IF (NPRT(18).EQ.6.OR.NPRT(18).EQ.9) GO TO 82                    VARTTH
      IF (NPRT(18).GE.12) GO TO 82                                    VARTTH
      DO  77  J=1,NBAG                                                HEDING
      IF (MNBAG(J).EQ.0) GO TO 77                                     HEDING
      MT = MT + 1                                                     HEDING
      NT = MT                                                         HEDING
      IF  (LNEW)  NT = 6                                              HEDING
C     P & E CARRIAGE CONTROL                                          PECONV
C     CALL CARCON(NT,1)                                               80386
      IT = MT - 20                                                    HEDING
      PAGE = FLOAT(MT) + XPAGE                                        HEDING
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      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                          PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                    PAGE
      IF (NT.EQ.6) NPG=NPG+1                                             PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                            PAGE
      WRITE (NT,78) J,(BAGTTL(I,J),I=1,5)                                HEDING
      IF  (.NOT.LNEW)  GO TO 72                                          HEDING
      DO  71  I=1,NLINES                                                 HEDING
   71 WRITE (NT, 79)  USEC(I),(ZTTH(JJ,I,IT),JJ=1,12)                    HEDING
   72 KBAG = 0                                                           HEDING
      KP = NPANEL(J)+1                                                   HEDING
      DO 73 K=1,KP                                                       HEDING
      KBAG = KBAG+1                                                      HEDING
   73 HEAD(KBAG) = PHED(K)                                               HEDING
      KP = MNBAG(J)                                                      HEDING
      DO 74 K=1,KP                                                       HEDING
      KBAG = KBAG+1                                                      HEDING
      M = MBAG(2,K,J)                                                    HEDING
   74 HEAD(KBAG) = SEG(M)                                                HEDING
      DO 76 J1=1,KBAG,4                                                  HEDING
      J2 = MIN0(J1+3,KBAG)                                               HEDING
      MT = MT + 1                                                        HEDING
      NT = MT                                                            HEDING
      IF  (LNEW)  NT = 6                                                 HEDING
C     P & E CARRIAGE CONTROL                                             PECONV
C     CALL CARCON(NT,1)                                                  80386
      IT = MT - 20                                                       HEDING
      PAGE = FLOAT(MT) + XPAGE                                           HEDING
      IF (NT.EQ.6) WRITE(NT,121) DATE,BLANK,NPG                          PAGE
      IF (NT.NE.6) WRITE(NT,121) DATE                                    PAGE
      IF (NT.EQ.6) NPG=NPG+1                                             PAGE
      WRITE (NT,21) COMENT,PAGE,VPSTTL,BDYTTL                            PAGE
      WRITE (NT,80)UNITM,J,(BAGTTL(I,J),I=1,5),(BLANK,J,HEAD(K),K=J1,J2)HEDING
      WRITE (NT,51) (BLANK,K=J1,J2)                                      HEDING
      WRITE (NT,38)                                                      HEDING
      IF  (.NOT.LNEW)  GO TO 76                                          HEDING
      JJ = 3*(J2-J1+1)                                                   HEDING
      DO  75  I=1,NLINES                                                 HEDING
   75 WRITE (NT, 81)  USEC(I),(ZTTH(K,I,IT),K=1,JJ)                      HEDING
   76 CONTINUE                                                           HEDING
   77 CONTINUE                                                           HEDING
   78 FORMAT('0',26X,'PARAMETERS FOR AIRBAG NO.',I2,4X,5A4//             HEDING
     *         16X,'SUPPLY CYLINDER   STATIC'/                           HEDING
     *         4X,'TIME',8X,'PRES.',4X,'TEMP.',4X,'PRES.',12X,'AIRBAG',  HEDING
     *  3X,'CENTER',14X,'AIRBAG  SEMIAXES',12X,'ORIENTATION (DEG.)'/     HEDING
     *  3X,'(MSEC)',7X,'(PSIG)  (DEG.R)   (PSIG)',8X,'X',8X,'Y',8X,'Z',  HEDING
     *  11X,'A',8X,'B',8X,'C',10X,'YAW',4X,'PITCH',5X,'ROLL'/ )          HEDING
   79 FORMAT (F9.3,3X,3F9.2,2(3X,3F9.3),3X,3F9.2)                        HEDING
   80 FORMAT('0',26X,'CONTACT FORCES (',A4,') ON AIRBAG NO.',I2,4X,5A4//HEDING
     *      /4X,'TIME',4(A1,11X,'AIRBAG',I2,' VS. ',A4,1X))              HEDING
   81 FORMAT (F9.3,4(3X,3F9.2))                                          HEDING
   82 RETURN                                                             HEDING
      END                                                                HEDING
```

```
      SUBROUTINE HERRON(HD3,NT1,THETO,THETOP)                          HERRON
C                                                    REV IV    07/23/86TWOPI
C     COMPUTES THETO - ANGLE OF JOINT STOP                             HERRON
C              THETOP- DERIVATIVE OF THETO WITH RESPECT TO PHI         HERRON
C                     .                                                HERRON
C         FROM HD3    - COMPONENTS OF VECTOR DEFINING PHI              HERRON
C              NT1    - INDEX TO TAB ARRAY DEFINING FUNCTION           HERRON
C                                                                      HERRON
      IMPLICIT REAL*8(A-H,O-Z)                                         HERRON
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                        HERRON
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                 TWOPI
      DIMENSION HD3(3)                                                 HERRON
      IF (TAB(NT1+1).LE.0.0) GO TO 30                                  HERRON
      IF (TAB(NT1+2).LE.0.0) GO TO 30                                  HERRON
C                                                                      HERRON
C     THETO = P1(CP) + SP*P2(CP)                                       HERRON
C                                                                      HERRON
C     THETOP = -SP*P1'(CP) + CP*P2(CP) - SP**2*P2'(CP)                 HERRON
C                                                                      HERRON
C         WHERE P1(X),P2(X) ARE THE TWO 5TH ORDER POLYNOMIALS DEFINED  HERRON
C                         IN TAB(NT1+5) AND TAB(NT1+11)                HERRON
C               P1'(X),P2'(X) ARE THEIR DERIVATIVES WITH RESPECT TO PHI HERRON
C           AND SP,CP ARE SIN(PHI) AND COS(PHI)                        HERRON
C                                                                      HERRON
      STH2 = 1.0-HD3(3)**2                                             HERRON
      STH  = DSQRT(STH2)                                               HERRON
      CP   = HD3(1)/STH                                                HERRON
      SP   = HD3(2)/STH                                                HERRON
      P1   = TAB(NT1+5 )+ CP*(TAB(NT1+6 )                              HERRON
     *                  + CP*(TAB(NT1+7 )                              HERRON
     *                  + CP*(TAB(NT1+8 )                              HERRON
     *                  + CP*(TAB(NT1+9 )                              HERRON
     *                  + CP*(TAB(NT1+10) )))))                        HERRON
      P2   = TAB(NT1+11)+ CP*(TAB(NT1+12)                              HERRON
     *                  + CP*(TAB(NT1+13)                              HERRON
     *                  + CP*(TAB(NT1+14)                              HERRON
     *                  + CP*(TAB(NT1+15)                              HERRON
     *                  + CP*(TAB(NT1+16) )))))                        HERRON
      P1P  = TAB(NT1+6 )+ CP*(2.0*TAB(NT1+7 )                          HERRON
     *                  + CP*(3.0*TAB(NT1+8 )                          HERRON
     *                  + CP*(4.0*TAB(NT1+9 )                          HERRON
     *                  + CP*(5.0*TAB(NT1+10) ))))                     HERRON
      P2P  = TAB(NT1+12)+ CP*(2.0*TAB(NT1+13)                          HERRON
     *                  + CP*(3 0*TAB(NT1+14)                          HERRON
     *                  + CP*(4.0*TAB(NT1+15)                          HERRON
     *                  + CP*(5.0*TAB(NT1+16) ))))                     HERRON
      THETO  = P1 + SP*P2                                              HERRON
      THETOP = CP*P2 - SP*(P1P + SP*P2P)                               HERRON
      GO TO 99                                                         HERRON
C                                                                      HERRON
C     EVALUATE THETO AND THETOP FROM REGULAR FUNCTION DEFINITION WHERE HERRON
```

```
C     THETO (ORDINATE) IS A FUNCTION OF PHI (ABSCISSA)  (0 < PHI < 2*PI)HERRON
C                                                                       HERRON
   30 PHI = DATAN2(HD3(2),HD3(1))                                       HERRON
      IF (PHI.LT.0.0) PHI = PHI + TWOPI                                 TWOPI
      THETO  = EVALFD(PHI,NT1,1)                                        HERRON
      THETOP = EVALFD(PHI,NT1,0)                                        HERRON
   99 RETURN                                                            HERRON
      END                                                               HERRON
```

```
      SUBROUTINE HICCSI(NPTS)                                           HICCSI
C                                                  REV IV    10/08/87PLTINC
C                                                                       HICCSI
C     COMPUTES HIC, HSI AND CSI FOR CVS PROGRAM.                        HICCSI
C                                                                       HICCSI
C     ASSUMES Z ARRAY CONTAINS                                          HICCSI
C     Z(I,1 ),I=1,NPTS : TIME POINTS (SECONDS)                          HICCSI
C     Z(I,JH),I=1,NPTS :  HEAD RESULTANT ACCELERATIONS (G'S)            HICCSI
C     Z(I,JC),I=1,NPTS : CHEST RESULTANT ACCELERATIONS (G'S)            HICCSI
C                                                                       HICCSI
C     NOTE:                                                             HICCSI
C     IF JDTPTS(1)=0,  HEAD RESULTANT IS NOT AVAILABLE (JH=NULL,JC=2).  HICCSI
C     IF JDTPTS(2)=0, CHEST RESULTANT IS NOT AVAILABLE (JH=2,JC=NULL).  HICCSI
C     OTHERWISE, JH=2 AND JC=3.                                         HICCSI
C                                                                       HICCSI
      COMMON/CDINT/ JDTPTS(18),Z(1000,3),DMMY(8068)                     80386
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           PAGE
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      REAL*8 TIME                                                       PAGE
      DIMENSION AREA(1000)                                              PLTINC
      IF  (NPTS.LT.25)  GO TO 25                                        HICCSI
      WRITE  (6,14) NPG                                                 PAGE
      NPG=NPG+1                                                         PAGE
   14 FORMAT (1H1, '   HIC, HSI AND CSI RESULTS',96X,'PAGE',I5)         PAGE
      JH  = 2                                                           HICCSI
      JC  = 3                                                           HICCSI
      IF  (JDTPTS(1).EQ.0)  JC = 2                                      HICCSI
      CSI = 0.0                                                         HICCSI
      HSI = 0.0                                                         HICCSI
      HIC = 0.0                                                         HICCSI
      CMX = Z(1,JC)                                                     HICCSI
      HMX = Z(1,JH)                                                     HICCSI
      IF  (JDTPTS(2).EQ.0)  GO TO 16                                    HICCSI
C                                                                       HICCSI
C     COMPUTE CSI - CHEST SEVERITY INDEX                                HICCSI
C                                                                       HICCSI
      H1  = SQRT(Z(1,JC)) * Z(1,JC)**2                                  HICCSI
      DO  15  I=2,NPTS                                                  HICCSI
      H2  = SQRT(Z(I,JC)) * Z(I,JC)**2                                  HICCSI
      DT  = Z(I,1) - Z(I-1,1)                                           HICCSI
      CSI = CSI + 0.5*DT*(H1+H2)                                        HICCSI
      IF  (CMX.GT.Z(I,JC))  GO TO 15                                    HICCSI
      CMX = Z(I,JC)                                                     HICCSI
      CMT = Z(I,1)                                                      HICCSI
   15 H1  = H2                                                          HICCSI
      CSI = 0.001*CSI                                                   HICCSI
   16 IF  (JDTPTS(1).EQ.0)  GO TO 23                                    HICCSI
C                                                                       HICCSI
C     COMPUTE HSI - HEAD SEVERITY INDEX - AND AREA TABLE                HICCSI
C                                                                       HICCSI
      AREA(1) = 0.0                                                     HICCSI
      H1  = SQRT(Z(1,JH)) * Z(1,JH)**2                                  HICCSI
```

```
      DO  17  I=2,NPTS                                                  HICCSI
      H2  = SQRT(Z(I,JH)) * Z(I,JH)**2                                  HICCSI
      DT  = 0.5*(Z(I,1) - Z(I-1,1))                                     HICCSI
      AREA(I) = AREA(I-1) + DT*(Z(I-1,JH)+Z(I,JH))                      HICCSI
      HSI = HSI + DT*(H1+H2)                                            HICCSI
      IF  (HMX.GT.Z(I,JH))  GO TO 17                                    HICCSI
      HMX = Z(I,JH)                                                     HICCSI
      HMT = Z(I,1)                                                      HICCSI
   17 H1  = H2                                                          HICCSI
      HSI = 0.001*HSI                                                   HICCSI
C                                                                       HICCSI
C      COMPUTE HIC - HEAD INJURY CRITERION - AND TIME DURATION HT1,HT2  HICCSI
C                                                                       HICCSI
      DO  19  K=2,NPTS                                                  HICCSI
      DO  18  L=K,NPTS                                                  HICCSI
      DT  = Z(L,1)  -  Z(K-1,1)                                         HICCSI
      DH  = AREA(L) - AREA(K-1)                                         HICCSI
      HT  = DH/DT                                                       HICCSI
      HM  = DT*SQRT(HT)*HT**2                                           HICCSI
      IF  (HM.LE.HIC)  GO TO 18                                         HICCSI
      HIC = HM                                                          HICCSI
      HT1 = Z(K-1,1)                                                    HICCSI
      HT2 = Z(L,1)                                                      HICCSI
      HA2 = Z(L,JH)                                                     HICCSI
      HA1 = Z(K-1,JH)                                                   HICCSI
      AVE = HT                                                          HICCSI
   18 CONTINUE                                                          HICCSI
   19 CONTINUE                                                          HICCSI
      HIC = 0.001*HIC                                                   HICCSI
      WRITE  (6,21)  HIC,HT1,HT2,HA1,HA2,AVE                            HICCSI
   21 FORMAT (1H0, '   HEAD INJURY CRITERION'//                         HICCSI
     *        '    HIC = ', F8.2,                                       HICCSI
     *              9X, 'TIME DURATION = ', F9.3, '  TO ', F9.3, ' MSEC'/ HICCSI
     *    20X, 'WITH HEAD RESULTANTS = ', F9.3, ' AND ', F9.3, ' G''S'//HICCSI
     *14X,'AVERAGE HEAD RESULTANT FOR TIME DURATION = ', F9.3, ' G''S') HICCSI
      WRITE  (6,22)  HSI,HMX,HMT                                        HICCSI
   22 FORMAT (1H0, '   HEAD SEVERITY INDEX'//                           HICCSI
     *        '    HSI = ', F8.2//                                      HICCSI
     *   '    MAX  HEAD RESULTANT = ', F9.3, ' G''S AT ', F9.3, ' MSEC')HICCSI
   23 IF  (JDTPTS(2).EQ.0)  GO TO 25                                    HICCSI
      WRITE  (6,24)  CSI,CMX,CMT                                        HICCSI
   24 FORMAT (1H0, '   CHEST SEVERITY INDEX'//                          HICCSI
     *        '    CSI = ', F8.2//                                      HICCSI
     *   '    MAX CHEST RESULTANT = ', F9.3, ' G''S AT ', F9.3, ' MSEC')HICCSI
   25 CONTINUE                                                          TGMOD1
      IF(NPTS.LT.25) WRITE(6,101) NPTS                                  TGMOD1
  101 FORMAT(1X,//,2X,'HIC, HSI AND CSI NOT COMPUTED BECAUSE THE NUMBER TGMOD1
     *OF POINTS TO BE USED IN THE COMPUTATION =',I2,',',/,2X            TGMOD1
     * 'WHICH IS LESS THAN THE MINIMUM REQUIREMENT OF 25 POINTS.',/)    TGMOD1
      RETURN                                                            TGMOD1
      END                                                               HICCSI
```

```
      SUBROUTINE HINPUT                                                 HINPUT
C                                                    REV IV    07/23/86TWOPI
C     CONTROLS THE INPUT OF CARDS F.8.A - F.8.D CONTAINING THE SETUP ANDHINPUT
C     CONTROL OF THE HARNESS BELT SYSTEM.                               HINPUT
C                                                                       HINPUT
C                                                                       HINPUT
      IMPLICIT REAL*8(A-H,O-Z)                                          HINPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           HINPUT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         HINPUT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       HINPUT
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          HINPUT
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         HINPUT
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           HINPUT
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       HINPUT
     *               JOINT(30),CGS(30),JS(30)                           HINPUT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      HINPUT
      LOGICAL*1 CGS,JS                                                  HINPUT
C     THIS COMMON/TEMTVS/ IS SHARED BY CINPUT, FINPUT, HINPUT AND FDINITHINPUT
      COMMON/TEMPVS/ JTITLE(5,51),NF(5),MS(3),KTITLE(31),DMMY(34966)    80386
      REAL JTITLE,KTITLE                                                HINPUT
      IF  (NHRNSS.EQ.0)  GO TO 99                                       HINPUT
C                                                                       HINPUT
C     INPUT CARD F.8.A                                                  HINPUT
C         (NOTE: NHRNSS NOW SUPPLIED ON INPUT CARD D.1)                 HINPUT
C         NBLTPH - NO. OF BELTS PER HARNESS                             HINPUT
C                                                                       HINPUT
      READ  (5,11)  (NBLTPH(I),I=1,NHRNSS)                              HINPUT
   11 FORMAT(18I4)                                                      HINPUT
      WRITE (6,12) NPG,NHRNSS,(NBLTPH(I),I=1,NHRNSS)                    PAGE
      NPG=NPG+1                                                         PAGE
   12 FORMAT('1 HARNESS-BELT SYSTEM INPUT',96X,'PAGE',I5/120X,          PAGE
     *       'CARDS F.8'/'  NO. OF HARNESSES =',I4//                    PAGE
     *        '  NO. OF BELTS PER HARNESS =',5I6)                       HINPUT
      J1 = 1                                                            HINPUT
      K1 = 1                                                            HINPUT
      DO 90 I=1,NHRNSS                                                  HINPUT
      IF (NBLTPH(I).LE.0) GO TO 90                                      HINPUT
      J2 = J1 + NBLTPH(I) -1                                            HINPUT
C                                                                       HINPUT
C     INPUT CARD F.8.B - NPTSPB - NO. OF POINTS PER BELT.               HINPUT
C                                                                       HINPUT
      READ (5,11) (NPTSPB(J),J=J1,J2)                                   HINPUT
      WRITE (6,13) I,(NPTSPB(J),J=J1,J2)                                HINPUT
   13 FORMAT('0 FOR HARNESS NO.',I3,' NO. OF POINTS PER BELT =',20I4)   HINPUT
      DO 80 J=J1,J2                                                     HINPUT
      IF (NPTSPB(J).EQ.0) GO TO 80                                      HINPUT
C                                                                       HINPUT
C     INPUT CARD F.8.C - 5 FUNCTION NOS AND LENGTH OF EACH BELT.        HINPUT
```

```
C                                                                        HINPUT
      READ  (5,14)     NF,XLONG(J)                                       HINPUT
   14 FORMAT(5I4,F12.6)                                                  HINPUT
      WRITE (6,15) I,J,NF,XLONG(J),UNITL                                 HINPUT
   15 FORMAT('0 HARNESS NO.',I3,' BELT NO.',I3,' FUNCTION NOS.',5I6,     HINPUT
     *       '  REFERENCE SLACK = ',F9.3,1X,A4/)                         HINPUT
      IF  (XLONG(J).EQ.0.0)  XLONG(J) = EPS(24)                          HINPUT
      WRITE  (6,16)                                                      HINPUT
   16 FORMAT ('0     K     KS     KE     NT     NPD    NDR    FUNCTION NOS.', HINPUT
     *         66X,'CARDS F.8.D'/)                                       CHGIII
C                                                                        HINPUT
C     SET UP POINTERS IN NTAB AND INITIAL VALUES OF TAB FOR BELT J       HINPUT
C        AS WAS DONE FOR OTHER CONTACTS IN SUBROUTINE FINPUT.            HINPUT
C                                                                        HINPUT
      NTHRNS(J) = MXNTB+1                                                HINPUT
      CALL FDINIT                                                        HINPUT
      K2 = K1 + NPTSPB(J) - 1                                            HINPUT
      DO 70 K=K1,K2                                                      HINPUT
C                                                                        HINPUT
C     INPUT CARD F.8.D                                                   HINPUT
C                                                                        HINPUT
      READ  (5,21)  KS,KE,NPD,NDR,NF, (BAR(L,K),L=1,3)                   HINPUT
   21 FORMAT (9I4,3F12.0)                                                HINPUT
      READ  (5,22)  (BAR(L,K),L=7,12)                                    HINPUT
   22 FORMAT (6F12.0)                                                    HINPUT
      ICHEC = 0                                                          CHGIII
      IF (K.EQ.K1.OR.K.EQ.K2) ICHEC = 1                                  CHGIII
      IF (ICHEC.EQ.1.AND.NPD.EQ.0) STOP 60                               CHGIII
      IF (ICHEC.EQ.1.AND.NDR.EQ.0) STOP 61                               CHGIII
      IF (NDR.EQ.0.AND.NPD.NE.0) STOP 62                                 CHGIII
      IBAR(1,K) = KS                                                     HINPUT
      IBAR(2,K) = KE                                                     HINPUT
      IBAR(4,K) = NPD                                                    HINPUT
      IBAR(5,K) = NDR                                                    HINPUT
      IBAR(3,K) = MXNTB+1                                                HINPUT
      CALL FDINIT                                                        HINPUT
      SQRER = 1.0                                                        HINPUT
      IF  (KE.NE.0)  SQRER = DSQRT(XDY(BAR(1,K),BD(7,KE),BAR(1,K)))      HINPUT
      DO  26  L=1,3                                                      HINPUT
      IF  (KE.NE.0)  BAR(L+6,K) = BD(L+3,KE)                             HINPUT
   26 BAR(L+3,K) = BAR(L,K)/SQRER                                        HINPUT
      WRITE  (6,31)  K,(IBAR(L,K),L=1,5),NF                              HINPUT
   31 FORMAT (11I6)                                                      HINPUT
   70 CONTINUE                                                           HINPUT
      WRITE  (6,71)  UNITL,UNITL,UNITL,UNITL                             HINPUT
   71 FORMAT ('0',12X,'BASE REFERENCE (',     A4,')',                    HINPUT
     *              7X,'ADJUSTED REFERFNCE (', A4,')',                   HINPUT
     *             11X,'OFFSET (',             A4,')',                   HINPUT
     *             11X,'PREFERRED DIRECTION (',A4,')'/                   HINPUT
     *         5X,'K', 4(8X,'X',8X,'Y',8X,'Z',3X) /)                     HINPUT
      WRITE  (6,72)  (K,(BAR(L,K),L=1,12),K=K1,K2)                       HINPUT
   72 FORMAT (I6,3X,3F9.3,3X,3F9.3,3X,3F9.3,3X,3F9.3)                    HINPUT
```

```
      K1 = K2+1                                                  HINPUT
   80 CONTINUE                                                   HINPUT
      J1 = J2+1                                                  HINPUT
   90 CONTINUE                                                   HINPUT
      DO  92  K=1,100                                            HINPUT
      BBDOT(K) = 0.0                                             HINPUT
      DO  91  J=1,2                                              HINPUT
   91 PLOSS(J,K) = 0.0                                           HINPUT
      DO  92  J=1,3                                              HINPUT
   92 BAR(J+12,K) = 0.0                                          HINPUT
   99 RETURN                                                     HINPUT
      END                                                        HINPUT
```

```
      SUBROUTINE HPTURB                                                 HPTURB
C                                                 REV IV    07/23/86TWOPI
      IMPLICIT REAL*8 (A-H,O-Z)                                         HPTURB
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           HPTURB
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         HPTURB
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),HPTURB
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       HPTURB
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       HPTURB
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          HPTURB
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         HPTURB
C     THIS COMMON/TEMPVS/ IS SHARED BY HPTURB, HBPLAY, HBELT AND HSETC. HPTURB
      COMMON/TEMPVS/ B(3,3,3),S(3,3),T(3),R(3),V(3),T1(3),T2(3),        HPTURB
     *              E(3,3,50),EDOT(3,50),FCE(3,50),FR(3,50),ZR(3,50),   HPTURB
     *              TR(3,50),U(3,50),PTLOSS(2,50),BL(50),FB(50),FP(50),HPTURB
     *              OLDBB(100),RHS(3,54),C(3,3,200),IJK(54,54)          HPTURB
     *              ,DMMY(29942)                                        80386
      DIMENSION BLOSS(2,20),HLOSS(2,5)                                  HPTURB
      EQUIVALENCE (BLOSS(1,1),C(1,1,1)) , (HLOSS(1,1),C(1,1,10))        HPTURB
      LOGICAL LAST                                                      HPTURB
      DATA MAXITR/10/                                                   HPTURB
      CALL ELTIME (1,39)                                                HPTURB
      CALL HBPLAY                                                       HPTURB
      DHT = 0.0                                                         HPTURB
      IF  (TIME.NE.0.0)  DHT = TIME - HTIME(1)                          HPTURB
      HTIME(1) = TIME                                                   HPTURB
      DO  11  J=1,100                                                   HPTURB
      PTLOSS(J,1) = 0.0                                                 HPTURB
      OLDBB(J) = BB(J)                                                  HPTURB
      DO  11  I=1,3                                                     HPTURB
   11 BAR(I,J) = BAR(I+3,J)                                             HPTURB
      TSEC = 1000.0*TIME                                                HPTURB
      IF  (NPRT(28).NE.0)  WRITE (6,12) TSEC,NPG,UNITL,UNITM,UNITL,     PAGE
     *                                  UNITL,UNITM,UNITL,UNITM         HPTURB
      IF  (NPRT(28).NE.0) NPG=NPG+1                                     PAGE
   12 FORMAT('1   HARNESS BELT RESULTS FOR TIME =',F9.3,' MSEC.',73X,   PAGE
     *       'PAGE',I5///                                               PAGE
     *       36X,'BELT STRAIN',6X,'(LOCAL OR ELLIPSOID)',18X,           CHGIII
     *       '(INERTIAL)',14X,'PENETRATION'/                            CHGIII
     *       '      POINT   POINT  SEGMENT LENGTH  ENERGY LOSS',5X,     HPTURB
     *       'REFERENCE POINT (',A4,')',13X,'BELT FORCES  (',A4,')',    AFREVS
     *       9X,'ENERGY LOSS'/                                          HPTURB
     *       '       NO.    INDEX    NO.   (',A4,')  (',2A4,')',7X,     HPTURB
     *       'X',8X,'Y',8X,'Z',13X,'X',10X,'Y',10X,'Z',8X,'(',2A4,')'/) HPTURB
      J1 = 1                                                            HPTURB
      K0 = 1                                                            HPTURB
      KNLO = 0                                                          HPTURB
      DO  61  NH=1,NHRNSS                                               HPTURB
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      IF  (NBLTPH(NH).LE.0)  GO TO 61                                  HPTURB
      ITER = 1                                                          HPTURB
      KNL1 = KNLO                                                       HPTURB
      KNLN = 0                                                          CHGIII
C                                                                       HPTURB
C     START OF   DO  59  ITER=1,MAXITR   LOOP                           HPTURB
C                                                                       HPTURB
   13 NJ2 = 54                                                          HPTURB
      DO  14  I=1,NJ2                                                   HPTURB
      DO  14  J=1,NJ2                                                   HPTURB
   14 IJK(I,J) = 0                                                      HPTURB
      KNLO = KNL1                                                       HPTURB
      J2   = J1 + NBLTPH(NH) - 1                                        HPTURB
      NTP  = 0                                                          HPTURB
      IJ   = 0                                                          HPTURB
      CALL HBELT (J1,J2,KNLO,1)                                         HPTURB
      KHO  = 0                                                          HPTURB
      KNLO = KNL1                                                       HPTURB
      DO  15  NB=J1,J2                                                  HPTURB
      IF  (NPTPLY(NB).LE.0)  GO TO 15                                   HPTURB
      NPTS = NPTPLY(NB)                                                 HPTURB
      CALL HSETC (NPTS,KHO,KNLO,NTP,IJ)                                 HPTURB
      KHO = KHO + NPTS                                                  HPTURB
      KNLO = KNLO + NPTS                                                HPTURB
   15 CONTINUE                                                          HPTURB
      KNLN = KNLO                                                       CHGIII
C                                                                       HPTURB
C     SET UP C AND IJK ELEMENTS FOR TIE-POINTS.                         HPTURB
C                                                                       HPTURB
      KNLO = KNL1                                                       HPTURB
      KNLK = KNLO + 1                                                   HPTURB
      K1   = KNLK                                                       HPTURB
      DO  22  NB=J1,J2                                                  HPTURB
      IF  (NPTPLY(NB).LE.0)  GO TO 22                                   HPTURB
      K2   = K1 + NPTPLY(NB) - 1                                        HPTURB
      DO  21  KNL=K1,K2                                                 HPTURB
      KI   = NL(1,KNL)                                                  HPTURB
      KS   = IABS(IBAR(1,KI))                                           HPTURB
      IF  (KS.LT.100)  GO TO 21                                         HPTURB
      KS1  = KS/100                                                     HPTURB
      DO  16  K=KNLK,KNL                                                HPTURB
      KK   = K                                                          HPTURB
      KI   = NL(1,K)                                                    HPTURB
      KS   = IABS(IBAR(1,KI))                                           HPTURB
      IF  (KS.LT.100)  GO TO 16                                         HPTURB
      KS2  = KS/100                                                     HPTURB
      IF  (KS2.EQ.KS1)  GO TO 17                                        HPTURB
   16 CONTINUE                                                          HPTURB
   17 IF  (KK.EQ.KNL)  GO TO 21                                         HPTURB
      KK1 = KK  - KNLO                                                  HPTURB
      KK2 = KNL - KNLO                                                  HPTURB
      IQ1 = MAX0(1,KK2-1)                                               HPTURB
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      IQ2 = MINO(KK2+1,KHO)                                             HPTURB
      DO  18  IQ=IQ1,IQ2                                                HPTURB
      IF  (IJK(KK2,IQ).EQ.0)  GO TO 18                                  HPTURB
      IJK(KK1,IQ) = IJK(KK2,IQ)                                         HPTURB
      IJK(KK2,IQ) = 0                                                   HPTURB
   18 CONTINUE                                                          HPTURB
      IJK(KK2,KK2) = IJ+1                                               HPTURB
      IJK(KK2,KK1) = IJ+2                                               HPTURB
      DO  20  J=1,3                                                     HPTURB
      DO  19  I=1,3                                                     HPTURB
      C(I,J,IJ+1) =  0.0                                                HPTURB
   19 C(I,J,IJ+2) =  0.0                                                HPTURB
      C(J,J,IJ+1) =  1.0                                                HPTURB
   20 C(J,J,IJ+2) = -1.0                                                HPTURB
      IJ    = IJ + 2                                                    HPTURB
   21 CONTINUE                                                          HPTURB
      K1    = K2 + 1                                                    HPTURB
   22 CONTINUE                                                          HPTURB
      MJ2 = -(KHO+NTP)                                                  HPTURB
      IF  (NPRT(28).LT.3)  GO TO 29                                     HPTURB
      NJ2 = -MJ2                                                        HPTURB
      DO  25  J=1,NJ2                                                   HPTURB
   25 WRITE  (6,26)  J,(RHS(I,J),I=1,3),(IJK(J,I),I=1,NJ2)              HPTURB
   26 FORMAT (I6,3F12.6,20I4/(42X,20I4))                                HPTURB
      DO  27  KLM=1,IJ                                                  HPTURB
   27 WRITE  (6,28)  KLM,((C(J,I,KLM),I=1,3),J=1,3)                     HPTURB
   28 FORMAT (I6,9F12.6)                                                HPTURB
   29 CALL FSMSOL (C,RHS,IJK,MJ2,IJ,54,200)                             HPTURB
      IF  (NPRT(28).LT.3)  GO TO 31                                     HPTURB
      DO  30  J=1,NJ2                                                   HPTURB
   30 WRITE  (6,26)  J,(RHS(I,J),I=1,3),(IJK(J,I),I=1,NJ2)              HPTURB
   31 ONE = 1.0                                                         HPTURB
      DELMAX = 0.0                                                      HPTURB
      SCALE = 1.0                                                       HPTURB
      DO  44  IT=1,2                                                    HPTURB
      K1 = KO                                                           HPTURB
      KH = 0                                                            HPTURB
      KR = NTP                                                          HPTURB
      DO  43  NB=J1,J2                                                  HPTURB
      IF  (NPTPLY(NB).LE.0)  GO TO 43                                   HPTURB
      K2 = K1 + NPTPLY(NB) - 1                                          HPTURB
      DO  42  K=K1,K2                                                   HPTURB
      KH = KH + 1                                                       HPTURB
      KR = KR + 1                                                       HPTURB
C                                                                       HPTURB
C     HERE K IS INDEX OF ALL POINTS IN PLAY                             HPTURB
C         KH IS INDEX OF ALL POINTS IN PLAY ON A SINGLE HARNESS         HPTURB
C         KR IS INDEX OF RHS ARRAY ELEMENTS                             HPTURB
C                                                                       HPTURB
      KI = NL(1,K)                                                      HPTURB
      KS    = IABS(IBAR(1,KI))                                          HPTURB
      IF  (KS.GT.100)  KS = MOD(KS,100)                                 HPTURB
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      IF  (IBAR(5,KI).EQ.0)  GO TO 32                                  HPTURB
      CALL MAT31 (D(1,1,KS),RHS(1,KR),R)                               HPTURB
      GO TO 37                                                         HPTURB
C                                                                      HPTURB
C     NOTE: ENDPOINTS (K - K1 & K2) MUST BE TYPE 5.                    HPTURB
C                                                                      HPTURB
   32 CALL DOT31 (E(1,1,KH),RHS(1,KR),T1)                              HPTURB
      IF  (IT.EQ.2)  GO TO 33                                          HPTURB
      DELMAX - DMAX1(DELMAX,DABS(T1(2)/DMIN1(BB(K),BB(K-1))))          HPTURB
      GO TO 34                                                         HPTURB
   33 BB(K  ) - BB(K  ) + SCALE*T1(2)                                  HPTURB
      BB(K-1) - BB(K-1) - SCALE*T1(2)                                  HPTURB
   34 DO  35  J-1,3                                                    HPTURB
   35 T2(J) - T1(1)*E(J,1,KH) + T1(3)*E(J,3,KH)                        HPTURB
      CALL MAT31 (D(1,1,KS),T2,R)                                      HPTURB
      IF  (NPRT(28).GE.3)  WRITE (6,36) K,T1,T2,R                      HPTURB
   36 FORMAT ('0',I6,3(3X,3F12.6))                                     HPTURB
   37 IF  (IT.EQ.2)  GO TO 39                                          HPTURB
      DO  38  J-1,3                                                    HPTURB
   38 DELMAX - DMAX1(DELMAX,DABS(R(J)/DMAX1(EPS(1),DABS(BAR(J+3,KI))))) HPTURB
      GO TO 42                                                         HPTURB
   39 DO  40  J-1,3                                                    HPTURB
   40 BAR(J+3,KI) - BAR(J+3,KI) + SCALE*R(J)                           HPTURB
      KE - IBAR(2,KI)                                                  HPTURB
      IF  (KE.EQ.0)  GO TO 42                                          HPTURB
      RER - XDY(BAR(4,KI),BD(7,KE),BAR(4,KI))                          HPTURB
      IF  (RER.LE.1.0)  GO TO 42                                       HPTURB
      SQRER - 1.0/DSQRT(RER)                                           HPTURB
      DO  41  J-1,3                                                    HPTURB
   41 BAR(J+3,KI) - SQRER*BAR(J+3,KI)                                  HPTURB
   42 CONTINUE                                                         HPTURB
      K1 - K2 + 1                                                      HPTURB
   43 CONTINUE                                                         HPTURB
      IF  (IT.EQ.2)  GO TO 44                                          HPTURB
      IF  (DELMAX.NE.0.0)  SCALE - DMIN1(ONE,EPS(1)/DELMAX)            HPTURB
   44 CONTINUE                                                         HPTURB
      IF  (NPRT(28).GE.2)  WRITE  (6,45)  ITER,DELMAX,SCALE            HPTURB
   45 FORMAT ('0  ITER -',I6,'  DELMAX -',F15.6,'  SCALE -',F15.6)     HPTURB
      LAST - DELMAX.LE.EPS(2) .OR. ITER.EQ.MAXITR                      HPTURB
      IF  (.NOT.LAST)  GO TO 52                                        HPTURB
      KH - 0                                                           HPTURB
      K1 - K0                                                          HPTURB
      HLOSS(1,NH) - 0.0                                                HPTURB
      HLOSS(2,NH) - 0.0                                                HPTURB
      DO  51  NB-J1,J2                                                 HPTURB
      BLOSS(1,NB) - 0.0                                                HPTURB
      BLOSS(2,NB) - 0.0                                                HPTURB
      IF  (NPTPLY(NB).LE.0)  GO TO 51                                  HPTURB
      K2 = K1 + NPTPLY(NB) - 1                                         HPTURB
      KK1 - NL(1,K1)                                                   HPTURB
      KK2 - NL(1,K2)                                                   HPTURB
      DO  46  K-KK1,KK2                                                HPTURB
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      DO  46  J=1,3                                              HPTURB
   46 BAR(J+12,K) = 0.0                                          HPTURB
      IF  (DHT.EQ.0.0)  GO TO 49                                 HPTURB
      DO  48  K=K1,K2                                            HPTURB
      KH = KH + 1                                                HPTURB
      KI = NL(1,K)                                               HPTURB
      PLOSS(2,KI ) = PLOSS(2,KI ) + DHT*PTLOSS(2,KH)             HPTURB
      IF  (K.EQ.K1)  GO TO 47                                    HPTURB
      BBDOT(K-1) = (BB(K-1)-OLDBB(K-1))/DHT                      HPTURB
      PLOSS(1,K-1) = PLOSS(1,K-1) + DHT*PTLOSS(1,KH-1)           HPTURB
      BLOSS(1,NB) = BLOSS(1,NB) + PLOSS(1,K-1)                   HPTURB
   47 DO  48  J=1,3                                              HPTURB
   48 BAR(J+12,KI) = (BAR(J+3,KI)-BAR(J,KI))/DHT                 HPTURB
      BBDOT(K2) = 0.0                                            HPTURB
      PLOSS(1,K2) = 0.0                                          HPTURB
   49 K1 = K2+1                                                  HPTURB
      DO  50  K=KK1,KK2                                          HPTURB
   50 BLOSS(2,NB) = BLOSS(2,NB) + PLOSS(2,K)                     HPTURB
      HLOSS(1,NH) = HLOSS(1,NH) + BLOSS(1,NB)                    HPTURB
      HLOSS(2,NH) = HLOSS(2,NH) + BLOSS(2,NB)                    HPTURB
   51 CONTINUE                                                   HPTURB
   52 IF  (NPRT(28).EQ.0)  GO TO 59                              HPTURB
      IF  (.NOT.LAST .AND. IABS(NPRT(28)).EQ.1)  GO TO 59        HPTURB
      K1 = K0                                                    HPTURB
      KH = 0                                                     HPTURB
      DO  57  NB=J1,J2                                           HPTURB
      IF  (NPTPLY(NB).LE.0)  GO TO 57                            HPTURB
      WRITE (6,53)  NB,NH                                        HPTURB
   53 FORMAT ('0  BELT NO.',I4,' OF HARNESS NO.',I4)             HPTURB
      K2 = K1 + NPTPLY(NB) - 1                                   HPTURB
      DO  54  K=K1,K2                                            HPTURB
      KH = KH + 1                                                HPTURB
      KI = NL(1,K)                                               HPTURB
      KS = IBAR(1,KI)                                            HPTURB
      BK = 0.0                                                   HPTURB
      IF  (K.NE.K1)  BK = BB(K-1)                                HPTURB
      PLS = 0.0                                                  HPTURB
      IF  (K.NE.K1)  PLS = PLOSS(1,K-1)                          HPTURB
      T(1) = BAR(4,KI)                                           HPTURB
      T(2) = BAR(5,KI)                                           HPTURB
      T(3) = BAR(6,KI)                                           HPTURB
      KJ = MOD(IABS(KS),100)                                     HPTURB
      IF  (LPMI(KJ).NE.0)  CALL DOT 1 (DPMI(1,1,KJ),BAR(4,KI),T) HPTURB
   54 WRITE (6,55) K,KI,KS,BK,PLS,(T(J),J=1,3),                  HPTURB
     *              (FCE(J,KH),J=1,3),PLOSS(2,KI)                HPTURB
   55 FORMAT (3I8,F10.3,F12.3,2X,3F9.3,3X,3F11.3,3X,F12.3)       HPTURB
      IF  (LAST)  WRITE (6,56)  BLOSS(1,NB),BLOSS(2,NB)          HPTURB
   56 FORMAT ('0    TOTAL BELT ENERGY LOSS',7X,F12.3,68X,F12.3)  HPTURB
      K1 = K2 + 1                                                HPTURB
   57 CONTINUE                                                   HPTURB
      IF  (LAST)  WRITE (6,58)  HLOSS(1,NH),HLOSS(2,NH)          HPTURB
   58 FORMAT ('0 TOTAL HARNESS ENERGY LOSS',7X,F12.3,68X,F12.3)  HPTURB
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   59 ITER = ITER + 1                                                    HPTURB
C                                                                       HPTURB
C        END OF   DO  59  ITER=1,MAXITR   LOOP                          HPTURB
C                                                                       HPTURB
      IF  (.NOT.LAST)  GO TO 13                                         HPTURB
      IF  (ITER.GT.MAXITR)  WRITE  (6,60)  MAXITR,TSEC,DELMAX,SCALE     HPTURB
   60 FORMAT ('0 HPTURB ITER =',I4,' AT TIME =',F8.3,                   HPTURB
     *         ' MSEC.  DELMAX =',F10.6,'  SCALE =',F10.6)              HPTURB
      J1 = J2 + 1                                                       HPTURB
      K0 = K1                                                           HPTURB
      KNLO = KNLN                                                       CHGIII
   61 CONTINUE                                                          HPTURB
      IF  (NPRT(28).LT.0)  NPRT(28) = 0                                 HPTURB
      CALL ELTIME (2,39)                                                HPTURB
      RETURN                                                            HPTURB
      END                                                               HPTURB
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      SUBROUTINE HSETC (NPTS,KHO,KNLO,NTP,IJ)                           HSETC
C                                                    REV III.2 08/08/84REVIII
      IMPLICIT REAL*8 (A-H,O-Z)                                         HSETC
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),HSETC
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       HSETC
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       HSETC
     *               XLONG(20),HTIME(2),IBAR(5,100),NI(2,100),          HSETC
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         HSETC
C     THIS COMMON/TEMPVS/ IS SHARED BY HPTURB, HBPLAY, HEELT AND HSETC. HSETC
      COMMON/TEMPVS/ B(3,3,3),S(3,3),T(3),R(3),V(3),T1(3),T2(3),        HSETC
     *               E(3,3,50),EDOT(3,50),FCE(3,50),FR(3,50),ZR(3,50),  HSETC
     *               TR(3,50),U(3,50),PTLOSS(2,50),BL(50),FB(50),FP(50),HSETC
     *               OLDBB(100),RHS(3,54),C(3,3,200),IJK(54,54)         HSETC
     *              ,DMMY(29942)  -                                     80386
      DIMENSION  KM(3),MK(2)                                            HSETC
      ONE = 1.0                                                         HSETC
      KNL = KNLO                                                        HSETC
      KH = KHO                                                          HSETC
      K1 = KHO + NTP + 1                                                HSETC
      K2 = KHO + NTP + NPTS                                             HSETC
      DO  60  K=K1,K2                                                   HSETC
C                                                                       HSETC
C     HERE K    IS INDEX OF IJK AND RHS ARRAYS                          HSETC
C          KH   IS INDEX OF POINTS IN PLAY ON EACH HARNESS              HSETC
C          KNL IS INDEX OF ALL POINTS IN PLAY                           HSETC
C          KI   IS INDEX OF ALL POINTS                                  HSETC
C                                                                       HSETC
      KH = KH + 1                                                       HSETC
      KNL = KNL + 1                                                     HSETC
C                                                                       HSETC
C     ZERO C(K,K) , C(K,K-1) , C(K,K+1) & RHS(K); SET IJK(K,K) = IJ     HSETC
C                                                                       HSETC
      KM(1) = K+1                                                       HSETC
      KM(2) = K-1                                                       HSETC
      KM(3) = K                                                         HSETC
      IF  (K.EQ.K2)  KM(1) = 0                                          HSETC
      IF  (K EQ K1)  KM(2) = 0                                          HSETC
      KK = IJ                                                           HSETC
      DO  12  L=1,3                                                     HSETC
      RHS(L,K) = 0.0                                                    HSETC
      IF  (KM(L).EQ.0)  GO TO 12                                        HSETC
      KK = KK+1                                                         HSETC
      DO  11  I=1,3                                                     HSETC
      DO  11  J=1,3                                                     HSETC
   11 C(I,J,KK) = 0.0                                                   HSETC
   12 CONTINUE                                                          HSETC
      IJ = IJ+1                                                         HSETC
      IJK(K,K   ) = IJ                                                  HSETC
C                                                                       HSETC
C     COMPUTE CNORM, IF ZERO, SET C(K,K) = I                            HSETC
C                                                                       HSETC
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      CNORM = 0.0                                                       HSETC
      IF  (K.NE.K2)  CNORM = FB(KH)/BL(KH)                              HSETC
      IF  (K.NE.K1)  CNORM = CNORM + FB(KH-1)/BL(KH-1)                  HSETC
      KI = NL(1,KNL)                                                    HSETC
      IF  (IABS(IBAR(1,KI)).GT.100)  GO TO 14                           HSETC
C     IF  (CNORM.NE.0.0)  GO TO 14                                      BUTLER1
      KK = IJK(K,K)                                                     HSETC
      DO  13  I=1,3                                                     HSETC
   13 C(I,I,KK) = ONE                                                   HSETC
      IF (CNORM.EQ.0 0) GO TO 60                                        BUTLER1
   14 KK = IBAR(3,KI)                                                   HSETC
      NFD = NTAB(KK+1)                                                  HSETC
      NFR = NTAB(KK+5)                                                  HSETC
C                                                                       HSETC
C     SET UP B(3,3,3) AND S(3,3)                                        HSETC
C                                                                       HSETC
      MK(1) = KH                                                        HSETC
      MK(2) = KH-1                                                      HSETC
      IF  (K.EQ.K2)  MK(1) = 0                                          HSETC
      IF  (K.EQ.K1)  MK(2) = 0                                          HSETC
      DO  18 M=1,2                                                      HSETC
      KK = MK(M)                                                        HSETC
      IF  (KK.NE.0 .AND. CNORM.NE.0.0)  GO TO 16                        HSETC
      DO  15  I=1,3                                                     HSETC
      S(I,M) = 0.0                                                      HSETC
      DO  15  J=1,3                                                     HSETC
   15 B(I,J,M) = 0.0                                                    HSETC
      GO TO 18                                                          HSETC
   16 CALL DOT31 (E(1,1,KH),U(1,KK),T)                                  HSETC
      KIM = KNL + 1 - M                                                 HSETC
      FB1 = FB(KK)/BL(KK)                                               HSETC
      FB2 = FP(KK)/BB(KIM) - FB1                                        HSETC
      FB3 = FP(KK)*BL(KK)/BB(KIM)**2                                    HSETC
      DO  17  I=1,3                                                     HSETC
      SGN = ONE                                                         HSETC
      IF  (FR(I,KH).LT.0.0)  SGN = -ONE                                 HSETC
      S(I,M) = SGN*(FB3*T(I))                                           HSETC
      DO  17  J=1,3                                                     HSETC
   17 B(I,J,M) = SGN*(FB1*E(J,I,KH) + FB2*T(I)*U(J,KK))                 HSETC
   18 CONTINUE                                                          HSETC
      DO  19  I=1,3                                                     HSETC
      S(I,3) = -(S(I,1) + S(I,2))                                       HSETC
      DO  19  J=1,3                                                     HSETC
   19 B(I,J,3) = -(B(I,J,1) + B(I,J,2))                                 HSETC
      IF  (NFR.EQ.0)    GO TO 20                                        HSETC
      R(1) = TAB(NFR+2)                                                 HSETC
      R(2) = TAB(NFR+4)                                                 HSETC
   20 R(3) = 0.0                                                        HSETC
      DO  50  M=1,3                                                     HSETC
      RH = 0.0                                                          HSETC
      IF  (M EQ.3)      GO TO 31                                        HSETC
      IF  (NFR.EQ.0)    GO TO 48                                        HSETC
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C                                                                       HSETC
C     CONSTRAINTS 1 AND 2                                               HSETC
C                                                                       HSETC
      SGN   = -ONE                                                      HSETC
      FR3   = DABS(FR(M,KH)) - R(M)*DABS(FR(3,KH))                      HSETC
      IF  (IBAR(1,KI).GT.0)  RH = FR3                                   HSETC
      IF  (FR3.LE.0.0)  GO TO 48                                        HSETC
      GO TO 40                                                          HSETC
C                                                                       HSETC
C     CONSTRAINT NO. 3                                                  HSETC
C                                                                       HSETC
   31 IF  (NFD.EQ.0)    GO TO 48                                        HSETC
      IF  (IBAR(1,KI).LT.0)  GO TO 40                                   HSETC
      SGN   = ONE                                                       HSETC
      RMAG2 = TR(1,KH)**2 + TR(2,KH)**2 + TR(3,KH)**2                   HSETC
      RMAG  = DSQRT(RMAG2)                                              HSETC
      RER2  = TR(1,KH)*E(1,3,KH)+ TR(2,KH)*E(2,3,KH)+ TR(3,KH)*E(3,3,KH)HSETC
      RER2  = EDOT(3,KH)*RER2                                           HSETC
      RER   = DSQRT(RER2)                                               HSETC
      PEN   = RMAG/RER - RMAG                                           HSETC
      RRDOT = BAR(4,KI)*BAR(13,KI)                                      HSETC
     *        + BAR(5,KI)*BAR(14,KI)                                    HSETC
     *        + BAR(6,KI)*BAR(15,KI)                                    HSETC
      KS = IABS(IBAR(1,KI))                                             HSETC
      IF  (KS.GT.100)  KS = MOD(KS,100)                                 HSETC
      CALL DOT31 (D(1,1,KS),BAR(13,KI),T)                               HSETC
      ERDOT = E(1,3,KH)*T(1) + E(2,3,KH)*T(2) + E(3,3,KH)*T(3)          HSETC
      C1    = PEN/RMAG2                                                 HSETC
      C2    = RMAG*EDOT(3,KH)/(RER*RER2)                                HSETC
      PDOT  = C1*RRDOT - C2*ERDOT                                       HSETC
      NFDZ = IBAR(3,KI)                                                 CHGIII
      CALL FRCDFL (PEN,PDOT,NFDZ,0,FDP,ELOSS)                           CHGIII
      CALL FRCDFL (PEN,PDOT,NFDZ,1,FD ,ELOSS)                           CHGIII
      RH    = FD + FR(3,KH)                                             HSETC
      PTLOSS(2,KH) = ELOSS                                              HSETC
      C1    = FDP*C1                                                    HSETC
      C2    = FDP*C2                                                    HSETC
      SGNB3 = -DSIGN(ONE,FR(3,KH))                                      HSETC
      DO  32  J=1,3                                                     HSETC
   32 B(3,J,3) = SGNB3*B(3,J,3) - C1*TR(J,KH) + C2*E(J,3,KH)            HSETC
   40 DO  47  LL=1,3                                                    HSETC
      L = 4 - LL                                                        HSETC
      IF  (KM(L).EQ.0)  GO TO 47                                        HSETC
      DO  42  J=1,3                                                     HSETC
   42 V(J) = R(M)*B(3,J,L) + SGN*B(M,J,L)                               HSETC
      KL = KM(L)                                                        HSETC
      KML = KNL + KL - K                                                HSETC
      KIL = NL(1,KML)                                                   HSETC
      IF  (IBAR(5,KIL).NE.0)  GO TO 43                                  HSETC
      KHL = KH + KL - K                                                 HSETC
      CALL DOT31 (E(1,1,KHL),V,T)                                       HSETC
      T(2) = R(M)*S(3,L) + SGN*S(M,L)                                   HSETC
```

```
      CALL MAT31 (E(1,1,KHL),T,V)                                        HSETC
   43 IF  (LL.NE.1)  GO TO 44                                            HSETC
      VE = V(1)*E(1,M,KH) + V(2)*E(2,M,KH) + V(3)*E(3,M,KH)              HSETC
      EV = 1.0                                                           HSETC
      IF  (IABS(IBAR(1,KI)).LT.100)                                      HSETC
     *          EV = DSIGN(ONE,VE)/DSQRT(V(1)**2+V(2)**2+V(3)**2)        HSETC
      RH = EV*RH                                                         HSETC
   44 IF  (IJK(K,KL).NE.0)  GO TO 45                                     HSETC
      IJ = IJ+1                                                          HSETC
      IJK(K,KL) = IJ                                                     HSETC
   45 KK = IJK(K,KL)                                                     HSETC
      DO  46  J=1,3                                                      HSETC
      VEV = EV*V(J)                                                      HSETC
      DO  46  I=1,3                                                      HSETC
   46 C(I,J,KK) = C(I,J,KK) + E(I,M,KH)*VEV                              HSETC
   47 CONTINUE                                                           HSETC
      DO  41  I=1,3                                                      HSETC
   41 RHS(I,K) = RHS(I,K) + RH*E(I,M,KH)                                 HSETC
      GO TO 50                                                           HSETC
   48 IF  (IBAR(1,KI).LE.0)  GO TO 50                                    HSETC
      KK = IJK(K,K)                                                      HSETC
      DO  49  I=1,3                                                      HSETC
      DO  49  J=1,3                                                      HSETC
   49 C(I,J,KK) = C(I,J,KK) + E(I,M,KH)*E(J,M,KH)                        HSETC
   50 CONTINUE                                                           HSETC
   60 CONTINUE                                                           HSETC
      RETURN                                                             HSETC
      END                                                                HSETC
```

```
      SUBROUTINE HYABF(B,Z,A,F)                                         HYABF
C                                                    REV IV    02/07/87HYABF
      IMPLICIT REAL*8(A-H,O-Z)                                          HYABF
C                                                                       HYABF
C     CALCULATES A, AZ, Z.AZ:  OLD FORM MUST BE DIAGONAL                HYABF
C                                                                       HYABF
      DIMENSION B(24),Z(1),A(3,3)                                       HYABF
      P2 = 0.0                                                          HYABF
      IF(B(1).LT.0.0)P2 = -B(1) - 2.0                                   HYABF
      F = 0.0                                                           HYABF
      DO 30 I = 1,3                                                     HYABF
      J = I                                                             HYABF
      IF(B(1).LT.0.0)GO TO 10                                           HYABF
      A(I,1) = 1.0/B(I)**2                                              HYABF
      GO TO 15                                                          HYABF
   10 A(I,1) = B(I+16)                                                  HYABF
      J = J + 1                                                         HYABF
      A(I,1) = HYFCN(A(I,1),Z(I),B(J),P2)                               HYABF
C     IF(P2.GT.0.0)A(I,1) = A(I,1)*DABS(Z(I)/B(J))**P2                  HYABF
   15 DO 20 J = 2,3                                                     HYABF
   20 A(I,J) = A(I,J-1)*Z(I)                                            HYABF
   30 F = F + A(I,3)                                                    HYABF
      RETURN                                                            HYABF
      END                                                               HYABF
```

```
      SUBROUTINE HYBND(M,Z,IV,U,C,X)                                    HYBND
C                                                  REV IV    02/07/87HYBND
      IMPLICIT REAL*8(A-H,O-Z)                                          HYBND
C                                                                       HYBND
C     SEARCHES FOR POINT NEAREST CORNER - DIRECTION C*U                 HYBND
C                                                                       HYBND
      DIMENSION Z(3,12),IV(12),U(3),X(3)                                HYBND
      DO 20 I = 1,M,2                                                   HYBND
      J = IV(I)                                                         HYBND
      ATST = C*(U(1)*Z(1,J) + U(2)*Z(2,J) + U(3)*Z(3,J))                HYBND
      IF(I.EQ.1)GO TO 10                                                HYBND
      TEST = AMAX - ATST                                                HYBND
      COMP = DMAX1(DABS(AMAX),DABS(ATST))                               HYBND
C PRECISION TEST -  TRY >1000??                                         HYBND
      IF(1000.*DABS(TEST).LT.COMP)TEST = 0.0                            HYBND
      IF(TEST)10,15,20                                                  HYBND
C     IF(AMAX-ATST)10,15,20                                             HYBND
   10 AMAX = ATST                                                       HYBND
      J1 = J                                                            HYBND
   15 J2 = J                                                            HYBND
   20 CONTINUE                                                          HYBND
      DO 25 I = 1,3                                                     HYBND
   25 X(I) = 0.5*(Z(I,J1) + Z(I,J2))                                    HYBND
      RETURN                                                            HYBND
      END                                                               HYBND
```

```
      SUBROUTINE HYBOX(E,T,P,N,Z,IV)                                    HYBOX
C                                                  REV IV    02/07/87HYBOX
      IMPLICIT REAL*8(A-H,O-Z)                                          HYBOX
C                                                                       HYBOX
C     COMPUTES THE INTERSECTION OF A PLANE WITH THE EDGES OF A BOX      HYBOX
C                                                                       HYBOX
      DIMENSION T(3),E(3),TU(3),T2(3),P(3)                              HYBOX
C TO BE SAFE IV AND Z SHOULD BE DIMENSION 14 IN CALLING PROGRAM         HYBOX
      DIMENSION IV(12)                                                  HYBOX
      DIMENSION Z(3,12)                                                 HYBOX
      DATA ONE/1.0D0/                                                   HYBOX
C T - PLANE VECTOR, P POINT IN PLANE                                    HYBOX
      TUV = 0.0                                                         HYBOX
      DO 10 I = 1,3                                                     HYBOX
      TU(I) = T(I)*E(I)                                                 HYBOX
      T2(I) = 2.0*TU(I)                                                 HYBOX
   10 TUV = TUV + T(I)*(E(I) + P(I))                                    HYBOX
      N = 0                                                             HYBOX
      J = 2                                                             HYBOX
      K = 3                                                             HYBOX
      DO 45 I = 1,3                                                     HYBOX
      CK = -E(K)                                                        HYBOX
      P1 = TUV                                                          HYBOX
      DO 40 LL = 1,2                                                    HYBOX
      P2 = P1 - T2(I)                                                   HYBOX
      P3 = P2 - T2(J)                                                   HYBOX
      P4 = P1 - T2(J)                                                   HYBOX
      M = N                                                             HYBOX
      IF(DSIGN(ONE,P2).EQ.DSIGN(ONE,P1))GO TO 15                        HYBOX
      M = M + 1                                                         HYBOX
      Z(I,M) = (P1/TU(I) - 1.0)*E(I)                                    HYBOX
      Z(J,M) = -E(J)                                                    HYBOX
      Z(K,M) =  CK                                                      HYBOX
   15 IF(DSIGN(ONE,P3).EQ.DSIGN(ONE,P2))GO TO 20                        HYBOX
      M = M + 1                                                         HYBOX
      Z(I,M) =  E(I)                                                    HYBOX
      Z(J,M) = (P2/TU(J) - 1.0)*E(J)                                    HYBOX
      Z(K,M) =  CK                                                      HYBOX
   20 IF(DSIGN(ONE,P3).EQ.DSIGN(ONE,P4))GO TO 25                        HYBOX
      M = M + 1                                                         HYBOX
      Z(I,M) = (P4/TU(I) - 1.0)*E(I)                                    HYBOX
      Z(J,M) =  E(J)                                                    HYBOX
      Z(K,M) =  CK                                                      HYBOX
   25 IF(DSIGN(ONE,P4).EQ.DSIGN(ONE,P1))GO TO 30                        HYBOX
      M = M + 1                                                         HYBOX
      Z(I,M) = -E(I)                                                    HYBOX
      Z(J,M) = (P1/TU(J) - 1.0)*E(J)                                    HYBOX
      Z(K,M) =  CK                                                      HYBOX
   30 IF(M.EQ N)GO TO 35                                                HYBOX
CHECK FOR PRECISION (+-+-.OR -+-+)                                      HYBOX
      IF(M.EQ.N+4)GO TO 35                                              HYBOX
C DELETE 0 LENGTH SIDE                                                  HYBOX
```

```
      IF((Z(I,M-1).EQ.Z(I,M)).AND.(Z(J,M-1).EQ.Z(J,M)))GO TO 35         HYBOX
      N = M                                                              HYBOX
   35 P1 = P1 - T2(K)                                                    HYBOX
   40 CK = -CK                                                           HYBOX
      J = K                                                              HYBOX
   45 K = I                                                              HYBOX
C                                                                        HYBOX
      IF(N.LT.6)GO TO 65                                                 HYBOX
      IV(1) = 1                                                          HYBOX
      IV(2) = 2                                                          HYBOX
      M = 2                                                              HYBOX
      DO 60 J = 3,N,2                                                    HYBOX
      D = DABS(Z(1,M)) + DABS(Z(2,M)) + DABS(Z(3,M))                     HYBOX
      DO 55 L = 3,N                                                      HYBOX
      DO 50 LL = 2,J                                                     HYBOX
      IF(IV(LL-1).EQ.L) GO TO 55                                         HYBOX
   50 CONTINUE                                                           HYBOX
      F = DABS(Z(1,M)-Z(1,L))+DABS(Z(2,M)-Z(2,L))+DABS(Z(3,M)-Z(3,L))   HYBOX
      IF(F.GT.D)GO TO 55                                                 HYBOX
      D = F                                                              HYBOX
      K = L                                                              HYBOX
   55 CONTINUE                                                           HYBOX
      M = K + 1                                                          HYBOX
      IF(MOD(K,2).EQ.0)M = K - 1                                         HYBOX
      IV(J) = K                                                          HYBOX
      IV(J+1) = M                                                        HYBOX
   60 CONTINUE                                                           HYBOX
   65 RETURN                                                             HYBOX
      END                                                                HYBOX
```

```
      SUBROUTINE HYDAD(D,A,DAD)                                        HYDAD
C                                                   REV IV    02/07/87HYDAD
      IMPLICIT REAL*8(A-H,O-Z)                                         HYDAD
COMPUTES D'A(*,1)D                                                     HYDAD
      DIMENSION D(3,3),A(3),DAD(3,3)                                   HYDAD
      DO 10 I = 1,3                                                    HYDAD
      DO 10 J = 1,3                                                    HYDAD
      DAD(I,J) = 0.0                                                   HYDAD
      DO 10 K = 1,3                                                    HYDAD
   10 DAD(I,J) = DAD(I,J) + D(K,I)*A(K)*D(K,J)                         HYDAD
      RETURN                                                           HYDAD
      END                                                              HYDAD
```

```
      SUBROUTINE HYEST(BM,BN,TAB)                                      HYEST
C                                                    REV IV    07/23/87HYEST
C LINEAR PROGRAM                                                       HYEST
      IMPLICIT REAL*8(A-H,O-Z)                                         HYEST
      DIMENSION BM(24),BN(24),TAB(8)                                   HYEST
      COMMON/TEMPVS/D12(3,3),A(3,3),B(3,3),XMN(3),RLN(3),XMM(3),       HYEST
     *              T(3),R(3),C(3,3),V(7),DMMY(35055)                  80386
C R GOES FROM M TO N   D12 = DM*DN'                                    HYEST
C R = 0 CANNOT BE SOLVED WITH THIS METHOD                              HYEST
      BE = 1.0                                                         HYEST
      RR = R(1)**2 + R(2)**2 + R(3)**2                                 HYEST
      IF(RR.EQ.0.0)GO TO 30                                            HYEST
C R.R = 0 INVALID                                                      HYEST
      M = 1                                                            HYEST
      N = 1                                                            HYEST
      IF(BM(1).LT.0.0)M = 2                                            HYEST
      IF(BN(1).LT.0.0)N = 2                                            HYEST
      PM = 2.                                                          HYEST
      PN = 2.                                                          HYEST
      IF(M.EQ.2)PM = -BM(1)                                            HYEST
      IF(N.EQ.2)PN = -BN(1)                                            HYEST
      DO 10 I = 1,3                                                    HYEST
      T(I) = R(I)                                                      HYEST
      DO 10 J = 1,3                                                    HYEST
   10 B(I,J) = D12(I,J)                                                HYEST
      IF(N.EQ.2)CALL DOTT33(D12,BN(8),B)                               HYEST
      DO 15 I = 1,3                                                    HYEST
      DO 15 J = 1,3                                                    HYEST
   15 C(I,J) = B(I,J)                                                  HYEST
      IF(M.EQ.2)CALL MAT33(BM(8),B,C)                                  HYEST
C C WILL TRANSFORM FROM NN TO MM                                       HYEST
      IF(M.EQ.2)CALL MAT31(BM(8),R,T)                                  HYEST
      CALL HYLPX(BM(M),BN(N))                                          HYEST
      BE = V(7)                                                        HYEST
      IF(V(7).LE.1.0)GO TO 30                                          HYEST
      CALL HYABF(BM(1),V(1),A,F1)                                      HYEST
      CALL HYABF(BN(1),V(4),B,F2)                                      HYEST
C ESTIMATE ALPHA                                                       HYEST
      AA = A(1,2)**2 + A(2,2)**2 + A(3,2)**2                           HYEST
      BB = B(1,2)**2 + B(2,2)**2 + B(3,2)**2                           HYEST
      ALP = DSQRT(AA/BB)                                               HYEST
      RA = F1**(1.0/PM)                                                HYEST
      RB = F2**(1.0/PN)                                                HYEST
      ALP = ALP*RA*F2/(RB*F1)                                          HYEST
C SCALE POINTS TO ELLIPSOIDS                                           HYEST
      DO 20 I = 1,3                                                    HYEST
      V(I)   = V(I)/RA                                                 HYEST
   20 V(I+3) = V(I+3)/RB                                               HYEST
C ESTIMATE BETA                                                        HYEST
      CALL MAT31(C,V(4),T)                                             HYEST
      BE = (V(1)-T(1))**2 + (V(2)-T(2))**2 + (V(3) - T(3))**2          HYEST
      BE = DSQRT(BE/RR)                                                HYEST
```

```
C STORE VALUES IN TAB ARRAY FOR CONTACT                                  HYEST
      TAB(1) = ALP                                                       HYEST
      DO 25 I = 1,6                                                      HYEST
   25 TAB(I+2) = V(I)                                                    HYEST
   30 TAB(2) = BE                                                        HYEST
      RETURN                                                             HYEST
      END                                                                HYEST
```

```
      DOUBLE PRECISION FUNCTION HYFCN(C,Z,A,P)                          HYFCN
C                                                  REV IV    02/07/87HYFCN
      IMPLICIT REAL*8(A-H,O-Z)                                          HYFCN
      HYFCN = C                                                         HYFCN
      IF(P.EQ.0.0)GO TO 10                                              HYFCN
      HYFCN = 0.0                                                       HYFCN
      IF(Z.EQ.0.0)GO TO 10                                              HYFCN
      Q = P*(DLOG(DABS(Z)) - DLOG(A))                                   HYFCN
      IF(Q.GT.-88.5) HYFCN = C*DEXP(Q)                                  HYFCN
   10 RETURN                                                            HYFCN
      END                                                               HYFCN
```

```
      SUBROUTINE HYLIM(A,U,B,V,C,W,Z,BD)                                HYLIM
C                                                     REV IV    12/11/87HYFIX
      IMPLICIT REAL*8(A-H,O-Z)                                          HYLIM
C GIVEN Z, FIND A,B,Z: ZEZ = 1,  ZEV = 0,  TZ = TP                      HYLIM
      DIMENSION BD(24)                                                  HYLIM
      DIMENSION U(3),V(3),W(3),EI(3),EJ(3),T(3),TV(3)                   HYLIM
      DIMENSION Z(3),E(3),EV(3),Q(3),S(3),EZ(3)                         HYLIM
      DIMENSION SM(3,3)                                                 HYLIM
      LOGICAL PASS,USEV                                                 HYLIM
      PASS = .FALSE.                                                    HYLIM
      ITER = 100                                                        HYLIM
      PP =  -1./BD(1)                                                   HYLIM
      POW = -BD(1) - 2.0                                                HYLIM
      P1  = -BD(1) - 1.0                                                HYLIM
      P01 =  1.0/P1                                                     HYLIM
      P2  =  -BD(1)/P1                                                  HYLIM
      DO 10 I = 1,3                                                     HYLIM
      TV(I) = 0.0                                                       HYLIM
   10 IF(V(I).NE.0.0)TV(I) = HYFCN(1.0/V(I),V(I),BD(I+1),P2)            HYFIX
C GET RECIPROCAL SET                                                    HYLIM
      CALL CROSS(V,W,EI)                                                HYLIM
      CALL CROSS(W,U,EJ)                                                HYLIM
      CALL CROSS(U,V,T)                                                 HYLIM
      EIU = EI(1)*U(1) + EI(2)*U(2) + EI(3)*U(3)                        HYLIM
      G = C*EIU                                                         HYLIM
C                                                                       HYLIM
      DO 55 IT = 1,ITER                                                 HYLIM
      EVM = 0.0                                                         HYLIM
      EVZ = 0.0                                                         HYLIM
      ZEZ = 0.0                                                         HYLIM
      USEV = .FALSE.                                                    HYLIM
      DO 15 I = 1,3                                                     HYLIM
      E(I) = HYFCN(BD(I+16),Z(I),BD(I+1),POW)                           HYLIM
      EV(I) = E(I)*V(I)                                                 HYLIM
      IF(EV(I).EQ.0.0)USEV = .TRUE.                                     HYLIM
      IF(DABS(EV(I)).GT.EVM)EVM = DABS(EV(I))                           HYLIM
      EZ(I) = E(I)*Z(I)                                                 HYLIM
      IF(DABS(EZ(I)).GT.EVZ)EVZ = DABS(EZ(I))                           HYLIM
   15 ZEZ = ZEZ + Z(I)*EZ(I)                                            HYLIM
      RHO  = ZEZ**PP                                                    HYLIM
      DO 20 I = 1,3                                                     HYLIM
   20 Z(I) = Z(I)/RHO                                                   HYLIM
      IF(PASS)GO TO 60                                                  HYLIM
      RHOZ = ZEZ/RHO                                                    HYLIM
      RHOV = EVM*RHOZ/RHO                                               HYLIM
      RHOZ = EVZ*RHOZ                                                   HYLIM
      IF(.NOT.USEV)GO TO 30                                             HYLIM
      RHOV = 1.0                                                        HYLIM
      DO 25 I = 1,3                                                     HYLIM
   25 EV(I) = TV(I)                                                     HYLIM
C WHAT IF NO TV IS 0 AND EV ARE ALL 0 ?                                 HYLIM
   30 DO 35 I = 1,3                                                     HYLIM
```

```
      EV(I) = EV(I)/RHOV                                                HYLIM
   35 EZ(I) = EZ(I)/RHOZ                                                HYLIM
C SET UP MATRIX                                                         HYLIM
      CALL CROSS(EV, T,SM(1,1))                                         HYLIM
      CALL CROSS(T ,EZ,SM(1,2))                                         HYLIM
      CALL CROSS(EZ,EV,SM(1,3))                                         HYLIM
      TZV = T(1)*SM(1,3) + T(2)*SM(2,3) + T(3)*SM(3,3)                 HYLIM
      TZ  = T(1)*Z(1)    + T(2)*Z(2)    + T(3)*Z(3)                    HYLIM
      ZEV = Z(1)*EV(1)   + Z(2)*EV(2)   + Z(3)*EV(3)                   HYLIM
      IF(TZV.EQ.0.0)STOP 39                                             HYLIM
      ZEV = ZEV/TZV                                                     HYLIM
      Q(1) = 0.0                                                        HYLIM
      Q(2) = -ZEV                                                       HYLIM
      IF(.NOT.USEV)Q(2) = Q(2)/P1                                       HYLIM
      Q(3) = (G - TZ)/TZV                                               HYLIM
      CALL MAT31(SM,Q,S)                                                HYLIM
      SS = 0.0                                                          HYLIM
      ZZ = 0.0                                                          HYLIM
      DO 50 I = 1,3                                                     HYLIM
      SS = SS + DABS(S(I))                                              HYLIM
      IF(DABS(Z(I)).LT.0.1*BD(I+1))GO TO 45                             HYLIM
      IF(DABS(S(I)).GT.DABS(Z(I)))S(I) = DSIGN(0.5*Z(I),S(I))           HYLIM
   45 Z(I) = Z(I) + S(I)                                                HYLIM
      IF(DABS(Z(I)).GT.BD(I+1))Z(I) = DSIGN(BD(I+1),Z(I))               HYLIM
   50 ZZ = ZZ + DABS(Z(I))                                              HYLIM
      IF(SS.LT.1.0E-10*ZZ)PASS = .TRUE.                                 HYLIM
   55 CONTINUE                                                          HYLIM
C                                                                       HYLIM
   60 A = (EI(1)*Z(1) + EI(2)*Z(2) + EI(3)*Z(3))/EIU                   HYLIM
      B = (EJ(1)*Z(1) + EJ(2)*Z(2) + EJ(3)*Z(3))/EIU                   HYLIM
      RETURN                                                            HYLIM
      END                                                               HYLIM
```

```
      SUBROUTINE HYLPR(J1,J2,ID,C,S,E,T)                                HYLPR
C                                                    REV IV    02/07/87HYLPR
      IMPLICIT REAL*8(A-H,O-Z)                                          HYLPR
      DIMENSION ID(16),C(16),S(9,8),E(9).T(7)                           HYLPR
C LINEAR PROGRAM ROUTINE USING SIMPLEX METHOD                           HYLPR
C J1 = J2 FORCED PIVOT ON COLUMN J1                                     HYLPR
CALCULATE COSTS                                                         HYLPR
      J = J1                                                            HYLPR
      IF(J.EQ.J2)GO TO 30                                               HYLPR
   10 DO 20 L = 1,7                                                     HYLPR
      T(L) = -C(L)                                                      HYLPR
      IF(C(L).EQ.10.)GO TO 20                                           HYLPR
      DO 15 I = 1,9                                                     HYLPR
   15 T(L) = T(L) + S(I,L)*C(I+7)                                       HYLPR
   20 CONTINUE                                                          HYLPR
      IF(J1.EQ.J2)GO TO 65                                              HYLPR
C FIND PIVOT COLUMN                                                     HYLPR
      DO 25 L = 1,7                                                     HYLPR
      J = L                                                             HYLPR
      IF(T(L).GT.0.0)GO TO 30                                           HYLPR
   25 CONTINUE                                                          HYLPR
      GO TO 65                                                          HYLPR
C FIND PIVOT ROW                                                        HYLPR
   30 K = 0                                                             HYLPR
      DO 40 I = 1,9                                                     HYLPR
C SAVE PIVOT COLUMN                                                     HYLPR
      E(I) = S(I,J)                                                     HYLPR
      IF(S(I,J).LE.0.0)GO TO 40                                         HYLPR
      IF(K.EQ.0)GO TO 35                                                HYLPR
      IF(S(I,8).GE.Z*S(I,J))GO TO 40                                    HYLPR
   35 K = I                                                             HYLPR
      Z = S(I,8)/S(I,J)                                                 HYLPR
   40 CONTINUE                                                          HYLPR
C REPLACE COLUMNS                                                       HYLPR
      IF(K.EQ.0)GO TO 65                                                HYLPR
      M = ID(J)                                                         HYLPR
      ID(J) = ID(K+7)                                                   HYLPR
      ID(K+7) = M                                                       HYLPR
      Q = C(J)                                                          HYLPR
      C(J) = C(K+7)                                                     HYLPR
      C(K+7) = Q                                                        HYLPR
      P = S(K,J)                                                        HYLPR
      DO 45 I = 1,9                                                     HYLPR
   45 S(I,J) = 0.0                                                      HYLPR
      S(K,J) = 1.0                                                      HYLPR
      DO 50 L = 1,8                                                     HYLPR
   50 S(K,L) = S(K,L)/P                                                 HYLPR
      E(K) = 1.0                                                        HYLPR
      DO 60 I = 1,9                                                     HYLPR
      IF(I.EQ.K)GO TO 60                                                HYLPR
      IF(E(I).EQ.0.0)GO TO 60                                           HYLPR
      DO 55 M = 1,8                                                     HYLPR
```

```
55 S(I,M) = S(I,M) - E(I)*S(K,M)                               HYLPR
60 CONTINUE                                                    HYLPR
   GO TO 10                                                    HYLPR
65 RETURN                                                      HYLPR
   END                                                         HYLPR
```

```
      SUBROUTINE HYLPX(BM,BN)                                           HYLPX
C                                                     REV IV   02/07/87HYLPX
C LINEAR PROGRAM EXEC                                                   HYLPX
      IMPLICIT REAL*8(A-H,O-Z)                                          HYLPX
      DIMENSION BM(23),BN(23)                                           HYLPX
      COMMON/TEMPVS/D12(3,3),P(3,3),Q(3,3),XMN(3),RLN(3),XMM(3),        HYLPX
     *              R(3),H(3),D(3,3),V(7),S(9,8),C(16),A(7),B(3),       HYLPX
     *              E(9),T(7),ID(16),IP(2),DMMY(34932)                  80386
      CALL MAT31(D,BN,B)                                                HYLPX
      DO 10 I = 1,3                                                     HYLPX
      B(I) = BM(I) - B(I) + R(I)                                        HYLPX
      A(I) = BM(I)                                                      HYLPX
   10 A(I+3) = BN(I)                                                    HYLPX
      A(7) = -1.0                                                       HYLPX
      DO 15 I = 1,16                                                    HYLPX
      C(I) = 0.0                                                        HYLPX
   15 ID(I) = I                                                         HYLPX
      C(7) = -1.0                                                       HYLPX
      DO 20 I = 1,9                                                     HYLPX
      DO 20 J = 1,8                                                     HYLPX
   20 S(I,J) = 0.0                                                      HYLPX
C                                                                       HYLPX
COSTS 0   0  -1                                                         HYLPX
C     I  -D  -R    A - DB  + R  (>0)      INF COST                      HYLPX
C     I   0   0    2A                                                   HYLPX
C     0   I   0    2B                                                   HYLPX
C                                                                       HYLPX
      DO 25 I = 1,6                                                     HYLPX
   25 S(I+3,I) = 1.0                                                    HYLPX
      DO 30 I = 1,3                                                     HYLPX
      C(I+7) = 10.                                                      HYLPX
      S(I,7) = -R(I)                                                    HYLPX
      S(I,I) = 1.0                                                      HYLPX
      S(I,8) = B(I)                                                     HYLPX
      S(I+3,8) = 2.0*A(I)                                               HYLPX
      S(I+6,8) = 2.0*A(I+3)                                             HYLPX
      DO 30 J = 1,3                                                     HYLPX
   30 S(I,J+3) = -D(I,J)                                                HYLPX
CHECK SIGN OF RHS                                                       HYLPX
      DO 40 I = 1,3                                                     HYLPX
      IF(B(I).GE.0.0)GO TO 40                                           HYLPX
      DO 35 J = 1,8                                                     HYLPX
   35 S(I,J) = -S(I,J)                                                  HYLPX
   40 CONTINUE                                                          HYLPX
      J1 = 1                                                            HYLPX
      J2 = 7                                                            HYLPX
C                                                                       HYLPX
      CALL HYLPR(J1,J2,ID,C,S,E,T)                                      HYLPX
      NK = 0                                                            HYLPX
      NZ = 0                                                            HYLPX
COUNT ZEROES IN SOLUTION                                                HYLPX
      DO 45 I = 1,7                                                     HYLPX
```

```
C TEST SHOULD PROBABLY BE AN EPSILON TEST, DABS(T(I)).GT.EPS            HYLPX
      IF((T(I).NE.0.0).OR.(C(I).EQ.10.))GO TO 45                        HYLPX
      NZ = NZ + 1                                                       HYLPX
      IP(NZ) = I                                                        HYLPX
   45 CONTINUE                                                          HYLPX
C SET PASS COUNT                                                        HYLPX
      NP = 1                                                            HYLPX
      IF(NZ.GT.0)NP = 2**NZ                                             HYLPX
C                                                                       HYLPX
      DO 55 M = 1,NP                                                    HYLPX
      NM = NK                                                           HYLPX
      NK = NK + 1                                                       HYLPX
      DO 50 I = 1,16                                                    HYLPX
      K = ID(I)                                                         HYLPX
      IF(K.GT.7)GO TO 50                                                HYLPX
      W = 0.0                                                           HYLPX
      IF(I.GT.7)W = S(I-7,8)                                            HYLPX
      V(K) = (W - A(K) + NM*V(K))/NK                                    HYLPX
   50 CONTINUE                                                          HYLPX
C LOOK FOR ALL SOLUTIONS                                                HYLPX
      IF(M.EQ.NP)GO TO 55                                               HYLPX
      J1 = IP(1)                                                        HYLPX
      IP(1) = IP(2)                                                     HYLPX
      IP(2) = J1                                                        HYLPX
      IF(T(J1).NE.0.0)GO TO 55                                          HYLPX
      J2 = J1                                                           HYLPX
      CALL HYLPR(J1,J2,ID,C,S,E,T)                                      HYLPX
   55 CONTINUE                                                          HYLPX
      RETURN                                                            HYLPX
      END                                                               HYLPX
```

```
      SUBROUTINE HYNTR(BM,BN,TAB)                                       HYNTR
C                                                    REV IV    02/07/87HYNTR
      IMPLICIT REAL*8(A-H,O-Z)                                          HYNTR
CALCULATIONS IN SEGMENT M'S REFERENCE                                   HYNTR
      DIMENSION BM(24),BN(24),TAB(8)                                    HYNTR
      COMMON/TEMPVS/D12(3,3),A(3,3),B(3,3),XMN(3),RLN(3),XMM(3),        HYNTR
     *              AZ(3),R(3),Z(3),DNM(3,3),DAD(3,3),DBD(3,3),         HYNTR
     *              BMD(3,3),TMP(3,3),S(5,6),ZVR(3),BZV(3),V(3),        HYNTR
     *              ZM(3),VN(3),F(2),BV(3),DMMY(34973)                  80386
      P1 = 2.0                                                          HYNTR
      P2 = 2.0                                                          HYNTR
      IF(BM(1).LT.-2.0)P1 = -BM(1)                                      HYNTR
      IF(BN(1).LT.-2.0)P2 = -BN(1)                                      HYNTR
      C1 =  P1 - 1.0                                                    HYNTR
      CN =  P2 - 1.0                                                    HYNTR
C DNM TRANSFORMS FROM M TO NN                                           HYNTR
      K = 8                                                             HYNTR
      DO 15 J = 1,3                                                     HYNTR
      DO 10 I = 1,3                                                     HYNTR
      BMD(I,J) = 0.0                                                    HYNTR
      IF(BM(1).LT.0.0)BMD(I,J) = BM(K)                                  HYNTR
      DNM(I,J) = D12(I,J)                                               HYNTR
   10 K = K + 1                                                         HYNTR
   15 IF(BM(1).GT.0.0)BMD(J,J) = 1.0                                    HYNTR
      IF(BN(1).LT.0.0)CALL DOTT33(BN(8),D12,DNM)                        HYNTR
      ALP = TAB(1)                                                      HYNTR
      BET = TAB(2)                                                      HYNTR
      DO 20 I = 1,3                                                     HYNTR
      ZM(I) = TAB(I+2)                                                  HYNTR
   20 VN(I) = TAB(I+5)                                                  HYNTR
C PUT VECTORS INTO M'S REFERENCE                                        HYNTR
      CALL DOT31(BMD,ZM,Z)                                              HYNTR
      CALL DOT31(DNM,VN,V)                                              HYNTR
      DO 25 I = 1,3                                                     HYNTR
   25 ZVR(I) = Z(I) - V(I) - BET*R(I)                                   HYNTR
C                                                                       HYNTR
      DO 40 ITER = 1,100                                                HYNTR
      CALL HYABF(BM,ZM,A,F(1))                                          HYNTR
      CALL HYABF(BN,VN,B,F(2))                                          HYNTR
      CALL DOT31(BMD,A(1,2),AZ)                                         HYNTR
      CALL DOT31(DNM,B(1,2),BV)                                         HYNTR
      CALL HYDAD(BMD,A,DAD)                                             HYNTR
      CALL HYDAD(DNM,B,DBD)                                             HYNTR
      CALL MAT31(DBD,R,S(1,5))                                          HYNTR
      CALL MAT31(DBD,ZVR,BZV)                                           HYNTR
      C2 = CN*ALP                                                       HYNTR
C SET UP S MATRIX                                                       HYNTR
      S(4,4) = 0.0                                                      HYNTR
      S(5,5) = 0.0                                                      HYNTR
      S(4,6) = (1.0 - F(2))/P2 -V(1)*BZV(1) -V(2)*BZV(2) -V(3)*BZV(3)   HYNTR
      S(5,6) = (1.0 - F(1))/P1                                          HYNTR
      S(4,5) = -BV(1)*R(1) - BV(2)*R(2) - BV(3)*R(3)                    HYNTR
```

```
      S(5,4) = 0.0                                                     HYNTR
      DO 30 I = 1,3                                                    HYNTR
      S(I,4) =  BV(I)                                                  HYNTR
      S(4,I) =  BV(I)                                                  HYNTR
      S(I,5) = -C2*S(I,5)                                              HYNTR
      S(5,I) =  AZ(I)                                                  HYNTR
      S(I,6) = -AZ(I) - ALP*BV(I) - C2*BZV(I)                          HYNTR
      DO 30 J = 1,3                                                    HYNTR
   30 S(I,J) = C1*DAD(I,J) + C2*DBD(I,J)                               HYNTR
      CALL HYSOL(S,5,5)                                                HYNTR
      TALP = ALP + S(4,6)                                              HYNTR
      IF(TALP.LE.0.0)TALP = ALP/2.0                                    HYNTR
      ALP = TALP                                                       HYNTR
      TBET = BET + S(5,6)                                              HYNTR
      IF(TBET.LE.0.0)TBET = BET/2.0                                    HYNTR
      BET = TBET                                                       HYNTR
      SS = 0.0                                                         HYNTR
      ZZ = 0.0                                                         HYNTR
      DO 35 I = 1,3                                                    HYNTR
      SS    = SS + DABS(S(I,6))                                        HYNTR
      Z(I) = Z(I) + S(I,6)                                             HYNTR
      ZZ    = ZZ + DABS(Z(I))                                          HYNTR
      V(I) = Z(I) - BET*R(I)                                           HYNTR
   35 ZVR(I) = 0.0                                                     HYNTR
      CALL MAT31(BMD,Z,ZM)                                             HYNTR
      CALL MAT31(DNM,V,VN)                                             HYNTR
CONVERGENCE TEST DEPENDS ON REAL*4 (1.0E-5) OR REAL*8 (??)             HYNTR
      IF(SS.LT.1.0E-10*ZZ)GO TO 50                                     HYNTR
      K = 1                                                            HYNTR
      L = 1                                                            HYNTR
      IF(BM(1).LT.0.0)K = 2                                            HYNTR
      IF(BN(1).LT.0.0)L = 2                                            HYNTR
      DO 37 I = 1,3                                                    HYNTR
      IF(DABS(ZM(I)).GT.BM(K)) ZM(I) = DSIGN(BM(K),ZM(I))              HYNTR
      IF(DABS(VN(I)).GT.BN(L)) VN(I) = DSIGN(BN(L),VN(I))              HYNTR
      K = K + 1                                                        HYNTR
   37 L = L + 1                                                        HYNTR
      CALL DOT31(BMD,ZM,Z)                                             HYNTR
      CALL DOT31(DNM,VN,V)                                             HYNTR
      DO 38 I = 1,3                                                    HYNTR
   38 ZVR(I) = Z(I) - V(I) - BET*R(I)                                  HYNTR
   40 CONTINUE                                                         HYNTR
C     WRITE(6,45)                                                      HYNTR
C  45 FORMAT(' HYNTR DID NOT CONVERGE, CONTACT IGNORED.')              HYNTR
      BET = 1.0                                                        HYNTR
   50 TAB(1) = ALP                                                     HYNTR
      TAB(2) = BET                                                     HYNTR
      DO 55 I = 1,3                                                    HYNTR
      TAB(I+2) = ZM(I)                                                 HYNTR
   55 TAB(I+5) = VN(I)                                                 HYNTR
      RETURN                                                           HYNTR
      END                                                              HYNTR
```

```
      DOUBLE PRECISION FUNCTION HYPEN(BD,E,V)                                HYPEN
C                                                      REV IV    02/07/87HYPEN
C   POINT OF MAXIMUM PENETRATION                                             HYPEN
C   SOLVES FOR VALUE OF ALP USED BY PLELP                                    HYPEN
C   POWERS OF HYPERELLIPSOID MAY BE DIFFERENT                                HYPEN
      IMPLICIT REAL*8(A-H,O-Z)                                               HYPEN
      DIMENSION BD(24),E(3),V(3)                                             HYPEN
      FX(A) = A**E(1)*V(1)+A**E(2)*V(2)+A**E(3)*V(3)-1.0                     HYPEN
      L = 1                                                                  HYPEN
      VM = V(1)                                                              HYPEN
      DO 10 I = 2,3                                                          HYPEN
      IF (V(I).LE.VM) GO TO 10                                               HYPEN
      L = I                                                                  HYPEN
      VM = V(I)                                                              HYPEN
   10 CONTINUE                                                               HYPEN
      A = V(1) + V(2) + V(3)                                                 HYPEN
      A = 1.0/A**(1.0/E(L))                                                  HYPEN
      DEL = A/2.0                                                            HYPEN
      AP = 0.0                                                               HYPEN
   12 F = FX(A)                                                              HYPEN
      IF (DABS(F).LT.1.D-08) GO TO 40                                        HYPEN
      IF (F) 16,40,14                                                        HYPEN
   14 IF (A-DEL.LE.0.0) DEL = A/2.0                                          HYPEN
      AP = A                                                                 HYPEN
      FP = F                                                                 HYPEN
      A = A - DEL                                                            HYPEN
      GO TO 12                                                               HYPEN
   16 IF (AP.NE.0.0) GO TO 18                                                HYPEN
      A = A + DEL                                                            HYPEN
      GO TO 12                                                               HYPEN
   18 AM = A                                                                 HYPEN
      FM = F                                                                 HYPEN
   20 IF (FP.EQ.FM) GO TO 40                                                 HYPEN
      DEL = -FM*(AP - AM)/(FP - FM)                                          HYPEN
      AN = AM + DEL                                                          HYPEN
      IF (AN.EQ.A) GO TO 40                                                  HYPEN
      A = AN                                                                 HYPEN
      F = FX(A)                                                              HYPEN
      IF (DABS(F).LT.1.D-08) GO TO 40                                        HYPEN
      IF (F) 18,40,22                                                        HYPEN
   22 FP = F                                                                 HYPEN
      AP = A                                                                 HYPEN
      GO TO 20                                                               HYPEN
   40 HYPEN = A                                                              HYPEN
      RETURN                                                                 HYPEN
      END                                                                    HYPEN
```

```
      SUBROUTINE HYREA (L,H,AREA,AB,BB)                                   HYFIX
C                                                     REV IV   12/11/87HYFIX
      IMPLICIT REAL*8(A-H,O-Z)                                            HYREA
      DIMENSION H(2,2,5)                                                  HYFIX
      AREA = 0.0                                                          HYREA
      AB = 0.0                                                            HYREA
      BB = 0.0                                                            HYREA
      IF (L.LT.2) GO TO 20                                                HYFIX
      DO 15 I = 1,L                                                       HYFIX
      AR = H(1,1,I)*H(2,2,I) - H(1,2,I)*H(2,1,I)                          HYFIX
      IF (AR.EQ.0.0) GO TO 5                                              HYFIX
      AB = AB + AR*(H(1,1,I) + H(1,2,I))                                  HYFIX
      BB = BB + AR*(H(2,1,I) + H(2,2,I))                                  HYFIX
      AREA = AREA + AR                                                    HYREA
    5 AR = H(1,2,I)*H(2,1,I+1) - H(1,1,I+1)*H(2,2,I)                      HYFIX
      IF (AR.EQ.0.0) GO TO 15                                             HYFIX
      AB = AB + AR*(H(1,1,I+1) + H(1,2,I))                                HYFIX
      BB = BB + AR*(H(2,1,I+1) + H(2,2,I))                                HYFIX
      AREA = AREA + AR                                                    HYREA
   15 CONTINUE                                                            HYFIX
      IF (AREA.LE.0.0) GO TO 20                                           HYFIX
      AREA = 3.0*AREA                                                     HYREA
      AB = AB/AREA                                                        HYREA
      BB = BB/AREA                                                        HYREA
C     AREA = AREA/6.0                                                     HYREA
   20 RETURN                                                              HYREA
      END                                                                 HYREA
                                                                          HYREA
```

```
      SUBROUTINE HYSOL(A,N,ND)                                         HYSOL
C                                                       REV IV    02/01/88MISDOT
      IMPLICIT REAL*8(A-H,O-Z)                                         HYSOL
      DIMENSION A(ND,6)                                                MISDOT
C ASSUMES PIVOT ON DIAGONAL , BYPASS 0'S                               HYSOL
      N1 = N + 1                                                       HYSOL
      DO 20 L = 1,N                                                    HYSOL
      IF(A(L,L).EQ.0.0)GO TO 20                                        HYSOL
      L1 = L + 1                                                       HYSOL
      DO 10 J = L1,N1                                                  HYSOL
   10 A(L,J) = A(L,J)/A(L,L)                                           HYSOL
      IF(L.EQ.N)GO TO 20                                               HYSOL
      DO 21 I = L1,N                                                   HYSOL
      IF(A(I,L).EQ.0.0)GO TO 21                                        HYSOL
      DO 15 J = L1,N1                                                  HYSOL
   15 A(I,J) = A(I,J) - A(I,L)*A(L,J)                                  HYSOL
   21 CONTINUE                                                         HYSOL
   20 CONTINUE                                                         HYSOL
      IF(N.EQ.1)GO TO 30                                               HYSOL
C BACKUP                                                               HYSOL
      DO 25 L = 2,N                                                    HYSOL
      I = N1 - L                                                       HYSOL
      L1 = I + 1                                                       HYSOL
      DO 25 J = L1,N                                                   HYSOL
   25 A(I,N1) = A(I,N1) - A(I,J)*A(J,N1)                               HYSOL
   30 RETURN                                                           HYSOL
      END                                                              HYSOL
```

```
      SUBROUTINE HYVAL(A,U,R,BD,L)                                    HYVAL
C                                                     REV IV   12/11/87HYFIX
      IMPLICIT REAL*8(A-H,O-Z)                                        HYVAL
C GIVEN A,U,R: COMPUTE A        Z = A*U + R                           HYVAL
      DIMENSION BD(24),U(3),R(3),RM(2)                                HYFIX
      ONE = 1.0                                                       HYFIX
      POW = -BD(1) - 2.0                                              HYVAL
C ARE THESE THE CORRECT TESTS??                                       HYFIX
      TEST = -BD(1)*0.000001                                          HYFIX
      TESD = 0.000001                                                 HYFIX
      CALL HYVBX(U,R,BD(2),M,RM)                                      HYVAL
      A = 0.0                                                         HYFIX
      IF (M.LT.L) GO TO 50                                            HYFIX
C THIS SHOULD NEVER HAPPEN  - IMPLIES R IS OUTSIDE BOX                HYFIX
      A = RM(L)                                                       HYVAL
      IF (DABS(A).LT.TESD) GO TO 50                                   HYFIX
      DEL = A/5.0                                                     HYFIX
      NSTEP = 0                                                       HYFIX
C ITERATION LOOP                                                      HYFIX
   10 DEL = DEL/4.0                                                   HYFIX
      NSTEP = NSTEP + 1                                               HYFIX
      IF (NSTEP.LT.100) GO TO 12                                      HYFIX
      WRITE(6,11) M,A,DEL,F1,F2,L,RM(1),RM(2),U,R,BD                  HYFIX
   11 FORMAT(' HYV ',I4,4F11.6,I3,2F11.6/4X,3F11.6,4X,3F11.6/         HYFIX
     *   4(2X,7F10.4/))                                               HYFIX
      STOP 102                                                        HYFIX
   12 F2 = HYVFN(A,U,R,BD,POW)                                        HYFIX
      IF (DABS(F2).LT.TEST) GO TO 50                                  HYFIX
      IF (F2) 20,50,30                                                HYFIX
   15 F2 = HYVFN(A,U,R,BD,POW)                                        HYFIX
      NSTEP = NSTEP + 1                                               HYFIX
      IF (NSTEP.LT.100) GO TO 17                                      HYFIX
      WRITE(6,11) M,A,DEL,F1,F2,L,RM(1),RM(2),U,R,BD                  HYFIX
      STOP 103                                                        HYFIX
   17 IF (DABS(F2).LT.TEST) GO TO 50                                  HYFIX
      IF (F2) 20,50,35                                                HYFIX
   20 IF (DSIGN(ONE,A).EQ.DSIGN(ONE,A+DEL)) GO TO 22                  HYFIX
      A = A/2.0                                                       HYFIX
      DL = -A                                                         HYFIX
      GO TO 23                                                        HYFIX
   22 DL = DEL                                                        HYFIX
      A = A + DEL                                                     HYFIX
   23 F1 = F2                                                         HYFIX
      GO TO 15                                                        HYFIX
   25 F2 = HYVFN(A,U,R,BD,POW)                                        HYFIX
      NSTEP = NSTEP + 1                                               HYFIX
      IF (NSTEP.LT.100) GO TO 27                                      HYFIX
      WRITE(6,11) M,A,DEL,F1,F2,L,RM(1),RM(2),U,R,BD                  HYFIX
      STOP 104                                                        HYFIX
   27 IF (DABS(F2).LT.TEST) GO TO 50                                  HYFIX
      IF (F2) 35,50,30                                                HYFIX
   30 IF (DSIGN(ONE,A).EQ.DSIGN(ONE,A-DEL)) GO TO 32                  HYFIX
```

```
      A = A/2.0                                                 HYFIX
      DL = -A                                                   HYFIX
      GO TO 33                                                  HYFIX
   32 DL = -DEL                                                 HYFIX
      A = A - DEL                                               HYFIX
   33 F1 = F2                                                   HYFIX
      GO TO 25                                                  HYFIX
   35 IF (F1.EQ.F2) GO TO 50                                    HYFIX
      A = A + F2*DL/(F1 - F2)                                   HYFIX
      IF (DABS(DEL).GT.TESD) GO TO 10                           HYFIX
C                                                               HYVAL
   50 RETURN                                                    HYVAL
      END                                                       HYVAL
```

```
      SUBROUTINE HYVBX(Q,S,B,M,RM)                                      HYVBX
C                                                    REV IV    02/07/87HYVBX
      IMPLICIT REAL*8(A-H,O-Z)                                          HYVBX
      DIMENSION Q(3),S(3),B(3),RM(2)                                    HYVBX
C FINDS LIMITS OF BOX IN DIRECTION Q,  Z = R*Q + S                      HYVBX
      LOGICAL VAL                                                       HYVBX
      M = 0                                                             HYVBX
      C = -1.0                                                          HYVBX
      DO 30 I = 1,3                                                     HYVBX
      IF(Q(I).EQ.0.0)GO TO 30                                           HYVBX
      DO 25 K = 1,2                                                     HYVBX
      VAL = .TRUE.                                                      HYVBX
      D = C*B(I) - S(I)                                                 HYVBX
      DO 10 J = 1,3                                                     HYVBX
      IF(J.EQ.I)GO TO 10                                                HYVBX
      IF(DABS(D*Q(J) + S(J)*Q(I)).GT.DABS(B(J)*Q(I)))VAL = .FALSE.      HYVBX
C     IF(DABS(R*Q(J) + S(J)).GT.B(J))VAL = .FALSE.                      HYVBX
   10 CONTINUE                                                          HYVBX
      IF(.NOT.VAL)GO TO 25                                              HYVBX
      R = D/Q(I)                                                        HYVBX
      IF(M.EQ.0)GO TO 20                                                HYVBX
      DO 15 L = 1,M                                                     HYVBX
      IF(R.EQ.RM(L)) GO TO 25                                           HYVBX
   15 CONTINUE                                                          HYVBX
   20 M = M + 1                                                         HYVBX
      RM(M) = R                                                         HYVBX
   25 C = -C                                                            HYVBX
   30 CONTINUE                                                          HYVBX
      IF(M.EQ.0)GO TO 35                                                HYVBX
      IF(RM(1).LT.RM(2))GO TO 35                                        HYVBX
      R = RM(1)                                                         HYVBX
      RM(1) = RM(2)                                                     HYVBX
      RM(2) = R                                                         HYVBX
   35 RETURN                                                            HYVBX
      END                                                               HYVBX
```

```
      DOUBLE PRECISION FUNCTION HYVFN(A,U,R,B,P)                        HYVFN
C                                                        REV IV    12/11/87HYVFN
      IMPLICIT REAL*8(A-H,O-Z)                                          HYVFN
      DIMENSION U(3),R(3),B(24)                                         HYVFN
      F = -1.0                                                          HYVFN
      DO 10 I = 1,3                                                     HYVFN
      Z = A*U(I) + R(I)                                                 HYVFN
      C = B(I+16)                                                       HYVFN
      IF (P.GT.0.0) C = HYFCN(C,Z,B(I+1),P)                             HYVFN
   10 F = F + C*Z**2                                                    HYVFN
      HYVFN = F                                                         HYVFN
      RETURN                                                            HYVFN
      END                                                               HYVFN
```

```
      SUBROUTINE IMPLS2(MODE,J,H)                                       IMPLS2
C                                                   REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE UPDATE WHEN JOINT J LOCKS TO APPLY IMPULSE   IMPLS2
C     TO SET P.(D(M)'W(M) - D(N)'W(N)) = 0                              IMPLS2
C                                                                       IMPLS2
C     ARGUMENTS:                                                        IMPLS2
C          MODE -   0: FULL LOCK         P = I                          IMPLS2
C                   1: AXIS (H) FREE     P = I-HH'                      IMPLS2
C                  -1: AXIS (H) LOCKED   P = HH'                        IMPLS2
C                                                                       IMPLS2
C          J     - JOINT IDENTIFICATION NUMBER                          IMPLS2
C                                                                       IMPLS2
C          H     - AXIS VECTOR                                          IMPLS2
C                                                                       IMPLS2
C                                                                       IMPLS2
      IMPLICIT REAL*8(A-H,O-Z)                                          IMPLS2
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           IMPLS2
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3.3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),IMPLS2
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       IMPLS2
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     IMPLS2
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    IMPLS2
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),IMPLS2
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   IMPLS2
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),IMPLS2
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              IMPLS2
     *               KQ1(12),KQ2(12),KQTYPE(12)                         IMPLS2
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          IMPLS2
      COMMON/TEMPVS/ SM(3),SN(3),TM(3,3),TN(3,3),T(3,4),TT(3,4)         IMPLS2
     *              ,DMMY(35065)                                        80386
      DIMENSION      TWA(3,3,30),TLA(3,3,30),H(3)                       IMPLS2
      CALL ELTIME(1,28)                                                 IMPLS2
      M = JNT(J)                                                        IMPLS2
      N = J+1                                                           IMPLS2
      DO 20 L=1,3                                                       IMPLS2
      DO 12 K=1,NGRND                                                   IMPLS2
      DO 12 I=1,3                                                       IMPLS2
      U1(I,K) = 0.0                                                     IMPLS2
   12 U2(I,K) = 0.0                                                     IMPLS2
      DO 13 K=1,NJNT                                                    IMPLS2
      DO 13 I=1,3                                                       IMPLS2
      V1(I,K) = 0.0                                                     IMPLS2
   13 V2(I,K) = 0.0                                                     IMPLS2
      IF (NQ.LE.0) GO TO 15                                             IMPLS2
      DO 14 K=1,NQ                                                      IMPLS2
      DO 14 I=1,3                                                       IMPLS2
   14 V3(I,K) = 0.0                                                     IMPLS2
   15 IF (NFLX.EQ.0) GO TO 18                                           IMPLS2
      DO 19 K=1,NFLX                                                    IMPLS2
      DO 19 I=1,3                                                       IMPLS2
```

```
19 V4(I,K) = 0.0                                                        IMPLS2
18 DO 16 I=1,3                                                          IMPLS2
   U2(I,M) = RPHI(I,M)*D(I,L,M)                                         IMPLS2
16 U2(I,N) =-RPHI(I,N)*D(I,L,N)                                         IMPLS2
   CALL DAUX(L)                                                         IMPLS2
   DO 17 K=1,NGRND                                                      IMPLS2
   DO 17 I=1,3                                                          IMPLS2
   TLA(I,L,K) = SEGLA(I,K)                                              IMPLS2
17 TWA(I,L,K) = WMEGD(I,K)                                              IMPLS2
20 CONTINUE                                                             IMPLS2
   CALL DOT33(D(1,1,M),TWA(1,1,M),TM)                                   IMPLS2
   CALL DOT33(D(1,1,N),TWA(1,1,N),TN)                                   IMPLS2
   CALL DOT31(D(1,1,M),WMEG(1,M), SM)                                   IMPLS2
   CALL DOT31(D(1,1,N),WMEG(1,N), SN)                                   IMPLS2
   DO 22 I=1,3                                                          IMPLS2
   DO 21 K=1,3                                                          IMPLS2
   T(I,K) = TM(I,K) - TN(I,K)                                           IMPLS2
21 TT(I,K) = T(I,K)                                                     IMPLS2
   T(I,4) = SN(I) - SM(I)                                               IMPLS2
22 TT(I,4) = H(I)                                                       IMPLS2
   IF (MODE.GE.0) CALL DSMSOL(T,3,3)                                    IMPLS2
   IF (MODE.GT.0) CALL DSMSOL(TT,3,3)                                   IMPLS2
   IF (MODE) 24,29,25                                                   IMPLS2
24 ST = 0.0                                                             IMPLS2
   STT = XDY(H,T,H)                                                     IMPLS2
   GO TO 26                                                             IMPLS2
25 ST = 1.0                                                             IMPLS2
   STT = -(H(1)*TT(1,4) + H(2)*TT(2,4) + H(3)*TT(3,4))                  IMPLS2
26 STT =  (H(1)* T(1,4) + H(2)* T(2,4) + H(3)* T(3,4))/STT              IMPLS2
   DO 27 I=1,3                                                          IMPLS2
27 T(I,4) = ST*T(I,4) + STT*TT(I,4)                                     IMPLS2
29 DO 30 K=1,NGRND                                                      IMPLS2
   DO 30 I=1,3                                                          IMPLS2
   DO 30 L=1,3                                                          IMPLS2
   SEGLV(I,K) = SEGLV(I,K) + T(L,4)*TLA(I,L,K)                          IMPLS2
30 WMEG (I,K) = WMEG (I,K) + T(L,4)*TWA(I,L,K)                          IMPLS2
   IF  (NPRT(3).NE.0)  CALL PRINT(6HIMPLS2)                             IMPLS2
   CALL ELTIME(2,28)                                                    IMPLS2
   RETURN                                                               IMPLS2
   END                                                                  IMPLS2
```

```
      SUBROUTINE IMPULS(I1,I2,I3)                                       IMPULS
C                                                   REV IV    07/24/86SLIP
C         ARGUMENTS: I1 = 1 - IMPULS FOR PLELP.                         IMPULS
C                         3 - IMPULS FOR SEGSEG.                        IMPULS
C                         4 - IMPULS FOR VISPR OR EJOINT                IMPULS
C                    I2 = INDEX OF CONTACTING SEGMENT OR JOINT AXIS     IMPULS
C                    I3 = INDEX OF PLANE, SEGMENT OR JOINT AXIS         IMPULS
C                                                                       IMPULS
C                                                                       IMPULS
      IMPLICIT REAL*8 (A-H,O-Z)                                         IMPULS
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           IMPULS
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),IMPULS
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       IMPULS
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     IMPULS
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    IMPULS
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),IMPULS
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), IMPULS
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), IMPULS
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               IMPULS
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   IMPULS
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),IMPULS
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              IMPULS
     *               KQ1(12),KQ2(12),KQTYPE(12)                         IMPULS
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          IMPULS
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           IMPULS
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      DIMENSION TEMP(3),DWR1(3),DWR2(3),DWR3(3),DWR4(3),VREL(3),DV(3)   IMPULS
      IF (TIME.EQ.0.0) GO TO 99                                         IMPULS
C                                                                       IMPULS
C     SPECIAL SETUP FOR CALL TO SUBROUTINE DAUX                         IMPULS
C     REPLACE SETUP WITH U1,U2,V1,V2,V3 = 0.                            IMPULS
C     ASSUME OTHER ARRAYS FROM PREVIOUS CALL TO DAUX.                   IMPULS
C                                                                       IMPULS
      CALL ELTIME(1,27)                                                 IMPULS
      CALL OUTPUT(0)                                                    IMPULS
      KQTEST = 0                                                        IMPULS
      NT = 0                                                            IMPULS
      IF (I1.EQ.1) NT = NTPL (I2,I3)                                    IMPULS
      IF (I1.EQ.3) NT = NTSEG(I2,I3)                                    IMPULS
      IF (NT.EQ.0) GO TO 29                                             IMPULS
      KQ = -NTAB(NT+1)                                                  IMPULS
      IF (KQ.LE.0) GO TO 29                                             IMPULS
      KQTYPE(KQ) = IABS(KQTYPE(KQ))                                     IMPULS
      CALL DAUX(0)                                                      IMPULS
   29 IF (NQ.LE.0) GO TO 31                                             IMPULS
      DO 30 J=1,NQ                                                      IMPULS
      DO 30 I=1,3                                                       IMPULS
   30 V3(I,J) = 0.0                                                     IMPULS
   31 DO 32 J=1,NGRND                                                   IMPULS
```

```
      DO 32 I=1,3                                                  IMPULS
      U1(I,J) = 0.0                                                IMPULS
   32 U2(I,J) = 0.0                                                IMPULS
      IF (NJNT.LE.0) GO TO 21                                      IMPULS
      DO 33 J=1,NJNT                                               IMPULS
      DO 33 I=1,3                                                  IMPULS
      V1(I,J) = 0.0                                                IMPULS
   33 V2(I,J) = 0.0                                                IMPULS
   21 IF (NFLX.EQ.0) GO TO 23                                      IMPULS
      DO 22 J=1,NFLX                                               IMPULS
      DO 22 I=1,3                                                  IMPULS
   22 V4(I,J) = 0.0                                                IMPULS
C                                                                  IMPULS
C     REPLACE CALLS TO CONTACT AND VISPR WITH SINGLE CALL          IMPULS
C     AT FIRST CONTACT IF NOT CONSTRAINT.                          IMPULS
C                                                                  IMPULS
   23 IF (I1.NE.1) GO TO 34                                        IMPULS
      NT = NTPL(I2,I3)                                             IMPULS
      M1 = MPL(1,I2,I3)                                            IMPULS
      M2 = MPL(2,I2,I3)                                            IMPULS
      M3 = MPL(3,I2,I3)                                            IMPULS
      CALL PLELP(M2,M3,M1,I3,NT)                                   IMPULS
      IF (NTAB(NT+1).LT.0) GO TO 37                                IMPULS
      K1 = M2                                                      IMPULS
      K2 = M1                                                      IMPULS
      GO TO 39                                                     IMPULS
   34 IF (I1.NE.3) GO TO 35                                        IMPULS
      NT = NTSEG(I2,I3)                                            IMPULS
      M1 = MSEG(1,I2,I3)                                           IMPULS
      M2 = MSEG(2,I2,I3)                                           IMPULS
      M3 = MSEG(3,I2,I3)                                           IMPULS
      CALL SEGSEG(I3,M1,M2,M3,NT)                                  IMPULS
      IF (NTAB(NT+1).LT.0) GO TO 37                                IMPULS
      K1 = I3                                                      IMPULS
      K2 = M2                                                      IMPULS
      GO TO 39                                                     IMPULS
   35 IF (I1.NE.4) WRITE (6,36) I1,I2,I3                           IMPULS
   36 FORMAT('0 IMPROPER ARGUMENTS TO SUBROUTINE IMPULS'/          IMPULS
     *         '  ARGUMENTS = ', 3I6 /                             IMPULS
     *         '  PROGRAM TERMINATED' )                            IMPULS
      IF  (I1.NE.4)  STOP 33                                       IMPULS
C                                                                  IMPULS
C     RECALL VISPR FOR JOINT STOP.                                 IMPULS
C                                                                  IMPULS
      IF (IABS(IPIN(I3)).NE.4) GO TO 25                            IMPULS
      CALL EJOINT(I2,I3)                                           IMPULS
      GO TO 26                                                     IMPULS
   25 CALL VISPR(I2,I3)                                            IMPULS
   26 K1 = IABS(JNT(I3))                                           IMPULS
      K2 = I3+1                                                    IMPULS
      GO TO 39                                                     IMPULS
C                                                                  IMPULS
```

```
C     SET UP SPECIAL U1,U2 FOR FIRST CONTACT OF CONSTRAINT.              IMPULS
C                                                                        IMPULS
   37 KQ = -NTAB(NT+1)                                                   IMPULS
      KQTEST = 1                                                         IMPULS
      KQTYPE(KQ) = -IABS(KQTYPE(KQ))                                     IMPULS
      K1 = KQ1(KQ)                                                       IMPULS
      K2 = KQ2(KQ)                                                       IMPULS
      IF (K1.GT.NSEG) GO TO 38                                           IMPULS
      CALL MAT31(A13(1,1,2*KQ-1),QQ(1,KQ),U1(1,K1))                      IMPULS
      CALL MAT31(A23(1,1,2*KQ-1),QQ(1,KQ),U2(1,K1))                      IMPULS
   38 IF (K2.GT.NSEG) GO TO 39                                           IMPULS
      CALL MAT31(A13(1,1,2*KQ  ),QQ(1,KQ),U1(1,K2))                      IMPULS
      CALL MAT31(A23(1,1,2*KQ  ),QQ(1,KQ),U2(1,K2))                      IMPULS
C                                                                        IMPULS
C     FINAL SETUP OF U1 AND U2                                           IMPULS
C                                                                        IMPULS
   39 DO 40 J=1,NGRND                                                    IMPULS
      DO 40 I=1,3                                                        IMPULS
      U1(I,J) = U1(I,J)*RW(J)                                            IMPULS
   40 U2(I,J) = U2(I,J)*RPHI(I,J)                                        IMPULS
      CALL DAUX(I1)                                                      IMPULS
      IF (KQTEST.EQ.1) KQTYPE(KQ) = IABS(KQTYPE(KQ))                     IMPULS
      IF (NPRT(10).NE.0) CALL PRINT(6HPREIMP)                            IMPULS
      IF (I1.GT.3) GO TO 51                                              IMPULS
      IF (NPRT(10).NE.0) WRITE (6,42) R1I,R2I                            IMPULS
   42 FORMAT ('0'/(6G20.8))                                              IMPULS
      CALL CROSS(WMEG (1,K1),R1I(1),TEMP)                                IMPULS
      CALL DOT31(D(1,1,K1),TEMP,DWR1(1))                                 IMPULS
      CALL CROSS(WMEG (1,K2),R2I(1),TEMP)                                IMPULS
      CALL DOT31(D(1,1,K2),TEMP,DWR2(1))                                 IMPULS
      CALL CROSS(WMEGD(1,K1),R1I(1),TEMP)                                IMPULS
      CALL DOT31(D(1,1,K1),TEMP,DWR3(1))                                 IMPULS
      CALL CROSS(WMEGD(1,K2),R2I(1),TEMP)                                IMPULS
      CALL DOT31(D(1,1,K2),TEMP,DWR4(1))                                 IMPULS
      TVREL = 0.0                                                        IMPULS
      TDV   = 0.0                                                        IMPULS
      DO 50 I=1,3                                                        IMPULS
      VREL(I) = SEGLV(I,K1)+DWR1(I) - SEGLV(I,K2)-DWR2(I)                IMPULS
      DV  (I) = SEGLA(I,K1)+DWR3(I) - SEGLA(I,K2)-DWR4(I)                IMPULS
      TVREL = TVREL + TTI(I)*VREL(I)                                     IMPULS
   50 TDV   = TDV   + TTI(I)*DV  (I)                                     IMPULS
      GO TO 53                                                           IMPULS
   51 CALL DOT31(D(1,1,K1),WMEG (1,K1),DWR1(1))                          IMPULS
      CALL DOT31(D(1,1,K2),WMEG (1,K2),DWR2(1))                          IMPULS
      CALL DOT31(D(1,1,K1),WMEGD(1,K1),DWR3(1))                          IMPULS
      CALL DOT31(D(1,1,K2),WMEGD(1,K2),DWR4(1))                          IMPULS
      TVREL = 0.0                                                        IMPULS
      TDV   = 0.0                                                        IMPULS
      DO 52 I=1,3                                                        IMPULS
      VREL(I) = DWR1(I) - DWR2(I)                                        IMPULS
      DV  (I) = DWR3(I) - DWR4(I)                                        IMPULS
      TVREL = TVREL + TTI(I)*VREL(I)                                     IMPULS
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   52 TDV   = TDV   + TTI(I)*DV  (I)                                      IMPULS
   53 ALPHA = 0.0                                                         IMPULS
C                                                                         IMPULS
C     NOTE: CREST IS SUPPLIED AS (1+E)/2 WHERE E IS THE CLASSICAL         IMPULS
C     COEFFICIENT OF RESTITUTION BUT WITH A RANGE OF -1 TO +1.            IMPULS
C     CREST HAS A RANGE OF 0 TO +1 WHERE 0 (E=-1) REPRESENTS NO IMPULSE.IMPULS
C                                                                         IMPULS
      IF (TDV.NE.0.0) ALPHA = -2.0*CREST*TVREL/TDV                        IMPULS
      IF (NPRT(10).NE.0) WRITE (6,42) DWR1,DWR2,DWR3,DWR4,                IMPULS
     *                                TTI,VREL,DV,                        IMPULS
     *                                TVREL,TDV,CREST,ALPHA               IMPULS
      DO 60 J=1,NGRND                                                     IMPULS
      DO 60 I=1,3                                                         IMP' LS
      SEGLV(I,J) = SEGLV(I,J) + ALPHA*SEGLA(I,J)                          IMPULS
   60 WMEG (I,J) = WMEG (I,J) + ALPHA*WMEGD(I,J)                          IMPULS
      IF  (NPRT(10).NE.0)  CALL OUTPUT(1)                                 IMPULS
      IF  (NPRT( 3).NE.0)  CALL PRINT(6HIMPULS)                           IMPULS
      CALL ELTIME(2,27)                                                   IMPULS
   99 RETURN                                                              IMPULS
      END                                                                 IMPULS
```

```
      SUBROUTINE INITAL                                                  INITAL
C                                                  REV IV    07/24/86SLIP
C     PERFORMS CARD INPUT AND COMPUTATIONS FOR INITIAL                  INITAL
C     POSITIONING OF THE CRASH VICTIM'S BODY SEGMENTS.                  INITAL
C                                                                        INITAL
      IMPLICIT REAL*8(A-H,O-Z)                                           INITAL
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           INITAL
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),INITAL
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)        INITAL
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     INITAL
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    INITAL
      COMMON/VPOSTN/ ZPLT(3),SPLT(3),AXV(3,6),VATAB(6,501,6),           VEHICL
     *               VT0(6),VDT(6),TIMEV(6),OMEGV(6),NVTAB(6),INDXV(6)  INITAL
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           INITAL
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       INITAL
     *               JOINT(30),CGS(30),JS(30)                           INITAL
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      INITAL
      LOGICAL*1 CGS,JS                                                  INITAL
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         INITAL
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TEMPVS/ TMP(140),WMGDEG(3,30),T(3),S(3),A(3,2),Z(3,3)      SLIP
     *               ,DMMY(34862)                                       80386
C                 NOTE : CHAIN ALSO USES TEMPVS.                        INITAL
      DIMENSION  YPR(3,30) , IYPR(4,30)                                 INITAL
C                                                                       INITAL
C     INPUT CARD G.1.A (PLOT COORDINATES OF VEHICLE REFERENCE ORIGIN)   INITAL
C                                                                       INITAL
      READ(5,22) ZPLT,I1,J1,I2,J2,I3                                    INITAL
   22 FORMAT(3F10.0,5I4)                                                INITAL
      S(1) = 10.0                                                       INITAL
      S(2) =  6.0                                                       INITAL
      S(3) =  1.0                                                       INITAL
C                                                                       INITAL
C     IF J1#0, INPUT CARD G.1.B (PLOT SCALING INPUT)                    INITAL
C                                                                       INITAL
      IF  (J1.NE.0)  READ (5,22) S                                      INITAL
      SPLT(1) = 1.0/S(3)                                                INITAL
      SPLT(2) = 1.0/S(3)                                                INITAL
      SPLT(3) = -(S(1)/S(2))/S(3)                                       INITAL
      WRITE  (6,23)  NPG,ZPLT,I1,J1,I2,J2,I3,S                          PAGE
      NPG=NPG+1                                                         PAGE
   23 FORMAT('1 SUBROUTINE INITAL INPUT',98X,'PAGE',I5/120X,'CARD G.1'/ PAGE
     *  '     ZPLT(X)   ZPLT(Y)   ZPLT(Z)    I1     J1     I2     J2     I3',INITAL
     *  '     SPLT(1)   SPLT(2)   SPLT(3)'/3F10.0,5I6,3F10.2)           INITAL
C                                                                       INITAL
C     INPUT CARDS G.2.A - G.2.N                                         INITAL
C                                                                       INITAL
C     INITIAL LINEAR POSITION (IN) AND (IF I3=1) VELOCITY (IN/SEC)      INITAL
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C     OF EACH BASE BODY SEGMENT. IF I3=0, VELOCITY WILL BE SET TO        INITAL
C     INITIAL VELOCITY OF VEHICLE. INPUTS IN INERTIAL REFERENCE.         INITAL
C                                                                        INITAL
      DO 37 J=1,NSEG                                                     INITAL
      IF(J.GT.1.AND.IABS(JNT(J-1)).GT.0) GO TO 37                        INITAL
      READ(5,24) (SEGLP(I,J),I=1,3),(SEGLV(I,J),I=1,3)                   INITAL
   24 FORMAT (6F10.0 , 4I3)                                              INITAL
      IF(I3.GT.0) GO TO 37                                               INITAL
      DO 36 I=1,3                                                        INITAL
   36 SEGLV(I,J) = SEGLV(I,NVEH)                                         INITAL
   37 CONTINUE                                                           INITAL
C                                                                        INITAL
C     INPUT CARDS G.3.A - G.3.N                                          INITAL
C                                                                        INITAL
C     FOR EACH BODY SEGMENT SUPPLY YAW, PITCH AND ROLL (DEGREES)         INITAL
C     AND (IF I3=1) THE ANGULAR VELOCITY IN LOCAL REFERENCE (DEG/SEC).   INITAL
C     IF I3=0, THE ANGULAR VELOCITY (BLANK ON INPUT CARDS) WILL BE SET   INITAL
C     EQUAL TO THE INITIAL ANGULAR VELOCITY OF THE VEHICLE.              INITAL
C                                                                        INITAL
      FIRST = 0.0                                                        INITAL
      DO 40 J=1,NSEG                                                     INITAL
      READ (5,24) (YPR(I,J),I=1,3),(WMGDEG(I,J),I=1,3),(IYPR(I,J),I=1,4)INITAL
      ID1 = IYPR(1,J)                                                    INITAL
      DO 38 I=1,3                                                        INITAL
      IF (ID1.EQ.0) IYPR(I,J) = I                                        INITAL
   38 WMEG(I,J) = WMGDEG(I,J)*RADIAN                                     INITAL
      IF  (ID1.GE.0)  GO TO 60                                           INITAL
C                                                                        INITAL
C     READ CARD G.3.J2 FOR SEGMENT NO. J WHEN IYPR(1,J) IS NEGATIVE.     INITAL
C                                                                        INITAL
      READ  (5,24)  A,II,IK,JJ,JK                                        INITAL
      IJ = II                                                            INITAL
      LK = IK                                                            INITAL
      DO  54  K=1,2                                                      INITAL
      IF  (IJ.GT.0)  GO TO 52                                            INITAL
      DO  51  I=1,3                                                      INITAL
   51 Z(I,LK) = A(I,K)                                                   INITAL
      GO TO 53                                                           INITAL
   52 DA1 = A(1,K)*RADIAN                                                INITAL
      DA2 = A(2,K)*RADIAN                                                INITAL
      SA1 = DSIN(DA1)                                                    INITAL
      SA2 = DSIN(DA2)                                                    INITAL
      CA1 = DCOS(DA1)                                                    INITAL
      CA2 = DCOS(DA2)                                                    INITAL
      IJ1 = IJ+1                                                         INITAL
      IJ2 = IJ+2                                                         INITAL
      IF  (IJ1.GT.3)  IJ1= IJ1-3                                         INITAL
      IF  (IJ2.GT.3)  IJ2= IJ2-3                                         INITAL
      SGN = 1.0                                                          INITAL
      IF  (SA1.LT.0.0 .AND. CA2.LT.0.0)  SGN = -1.0                      INITAL
      Z(IJ ,LK) = SGN*SA1*CA2                                            INITAL
      Z(IJ1,LK) = SGN*SA1*SA2                                            INITAL
```

```
      Z(IJ2,LK) = SGN*CA1*CA2                                          INITAL
   53 IJ = JJ                                                          INITAL
   54 LK = JK                                                          INITAL
      ZDOTIJ = Z(1,IK)*Z(1,JK) + Z(2,IK)*Z(2,JK) + Z(3,IK)*Z(3,JK)     INITAL
      ZDOTII = Z(1,IK)*Z(1,IK) + Z(2,IK)*Z(2,IK) + Z(3,IK)*Z(3,IK)     INITAL
      RATIO = ZDOTIJ/ZDOTII                                            INITAL
      DO 55 I=1,3                                                      INITAL
   55 Z(I,JK) = Z(I,JK) - RATIO*Z(I,IK)                                INITAL
      LK = 6-IK-JK                                                     INITAL
      IT = MOD(JK-IK+3,3)                                              INITAL
      IF (IT.EQ.1) CALL CROSS(Z(1,IK),Z(1,JK),Z(1,LK))                 INITAL
      IF (IT.EQ.2) CALL CROSS(Z(1,JK),Z(1,IK),Z(1,LK))                 INITAL
      DO 57 K=1,3                                                      INITAL
      IYPR(K,J) = 4-K                                                  INITAL
      SUM = 0.0                                                        INITAL
      DO 56 I=1,3                                                      INITAL
   56 SUM = SUM + Z(I,K)**2                                            INITAL
      SQUM = DSQRT(SUM)                                                INITAL
      DO 57 I=1,3                                                      INITAL
   57 D(K,I,J) = Z(I,K)/SQUM                                           INITAL
      CALL YPRDEG (D(1,1,J),YPR(1,J))                                  INITAL
      IF (FIRST.EQ.0.0) WRITE (6,58)                                   INITAL
   58 FORMAT('0 INITIAL ANGULAR ROTATIONS COMPUTED FROM CARDS G.3.J2'// INITAL
     *        ' SEGMENT',10X,'SEGMENT PRIMARY AXIS',                   INITAL
     *        12X,'SEGMENT SECONDARY AXIS',30X,'ANGULAR ROTATIONS (DEG)'/INITAL
     *        ' NO. SEG',9X,'A1',8X,'A2',8X,'A3',11X,'B1',8X,'B2',8X,  INITAL
     *        'B3',7X,'II  IK  JJ  JK',9X,'YAW',6X,'PITCH',5X,'ROLL'/)  INITAL
      FIRST = 1.0                                                      INITAL
      WRITE (6,59) J,SEG(J),A,II,IK,JJ,JK,(YPR(I,J),I=1,3)             INITAL
   59 FORMAT (I4,1X,A4,3X,3F10.3,3X,3F10.3,3X,4I4,3X,3F10.3)           INITAL
   60 M = IYPR(4,J)                                                    INITAL
      IF (M.EQ.0) M=NGRND                                              INITAL
      IF (M.GE.J .AND. M.LE.NSEG) STOP 24                              INITAL
      IF (J.EQ.1) GO TO 80                                             VAXCHG
      IF (M.LT.0 .AND. -M.NE.IABS(JNT(J-1))) STOP 25                   INITAL
   80 CALL DRCIJK (D,YPR,IYPR,HT,J)                                    VAXCHG
      IF (I3.GT.0) GO TO 40                                            INITAL
      CALL DOT31(D(1,1,NVEH),WMEG(1,NVEH),T)                           INITAL
      CALL MAT31(D(1,1,J),T,WMEG(1,J))                                 INITAL
      DO 39 I=1,3                                                      INITAL
   39 WMGDEG(I,J) = WMEG(I,J)/RADIAN                                   INITAL
   40 CONTINUE                                                         INITAL
      CALL VEHPOS                                                      INITAL
      IF(NJNT.EQ.0) GOTO 41                                            JDRIFT
      CALL CHAIN(0)                                                    JDRIFT
      CALL EJOINT(1,0)                                                 JDRIFT
      DO 62 J=1,NJNT                                                   JDRIFT
      IF(IABS(IPIN(J)).NE.4) GOTO 62                                   JDRIFT
      IF(IEULER(J).NE.2) GOTO 62                                       JDRIFT
      DA1 = ANG(2,J) + CONST(2,J)                                      JDRIFT
      CONST(4,J) = DCOS(DA1)                                           JDRIFT
      CONST(5,J) = DSIN(DA1)                                           JDRIFT
```

```
  62  CONTINUE                                                          JDRIFT
C                                                                       INITAL
C     OUTPUT INITIAL BODY SEGMENT POSITIONS.                            INITAL
C                                                                       INITAL
  41  WRITE (6,42) UNITL,UNITL,UNITT                                    JDRIFT
   42 FORMAT('0 INITIAL POSITIONS (INERTIAL REFERENCE)',70X,'CARDS G.2'/INITAL
     *      /'  SEGMENT',11X,'LINEAR POSITION (',A4,')',                INITAL
     *       14X,'LINEAR VELOCITY (',A4,'/',A4,')'/                     AFREVS
     *       '  NO. SEG',2(9X,'X',11X,'Y',11X,'Z',5X) )                 INITAL
      WRITE (6,43) (J,SEG(J),(SEGLP(I,J),I=1,3),(SEGLV(I,J),I=1,3)      INITAL
     *              ,J=1,NSEG)                                          INITAL
   43 FORMAT(I4,1X,A4,3X,3F12.5,3X,3F12.5)                              INITAL
      WRITE (6,44) UNITT                                                INITAL
   44 FORMAT('0 INITIAL ANGULAR ROTATION AND VELOCITY',71X,'CARDS G.3'//INITAL
     *       '  SEGMENT',11X,'ANGULAR ROTATION (DEG)',                  AFREVS
     *       14X,'ANGULAR VELOCITY (DEG/',A4,')'/                       INITAL
     *       '  NO. SEG',8X,'YAW',8X,'PITCH',7X,'ROLL',                 INITAL
     *       13X,'X',11X,'Y',11X,'Z',15X,'IYPR' )                       INITAL
      WRITE (6,46) (J,SEG(J),(YPR(I,J),I=1,3),(WMGDEG(I,J),I=1,3),      INITAL
     *              (IYPR(I,J),I=1,4),J=1,NSEG)                         INITAL
   46 FORMAT(I4,1X,A4,3X,3F12.5,3X,3F12.5,3X,4I4)                       INITAL
      IF (I3.EQ.0) WRITE (6,45)                                         INITAL
   45 FORMAT('0 LINEAR AND ANGULAR VELOCITIES HAVE BEEN SET EQUAL TO THEINITAL
     * INITIAL VEHICLE VELOCITIES.')                                    INITAL
      IF  (NHRNSS.NE.0)  CALL HBPLAY                                    INITAL
      IF  (I1.EQ.15)  CALL EQUILB (YPR,IYPR)                            INITAL
      CALL UNIT1(0)                                                     JDRIFT
      CALL ROTATE                                                       INITAL
      CALL ELTIME(2,2)                                                  INITAL
      RETURN                                                            INITAL
      END                                                               INITAL
```

```
      SUBROUTINE INTERS(A,B,XM,T,X,V,AX)                                INTERS
C                                               REV IV    07/23/86TWOPI
C     DETERMINES INTERSECTION OF ELLIPSOIDS                             INTERS
C         X'AX = 1                                                      INTERS
C         (X'-M')B(X-M) = 1                                             INTERS
C     WHERE A AND B ARE ELLIPSOID MATRICES                              INTERS
C     IF T ENTERS AS +1.0 , A IS EXTERNAL TO B AND                      INTERS
C                    AS -1.0 , A IS INTERNAL TO B.                      INTERS
C                                                                       INTERS
C     IF V ENTERS AS NON-ZERO, WILL USE PREVIOUS VALUE FOR START.       INTERS
C     (AX) RETURNS AS (A)*(X).                                          INTERS
C                                                                       INTERS
C     RETURNS T>1 - NO INTERSECTION                                     INTERS
C             T<1 - INTERSECTION IN WHICH CASE X WILL                   INTERS
C                   CONTAIN COORDINATES OF CONTACT OF                   INTERS
C                   CONTRACTED ELLIPSOIDS.                              INTERS
C                                                                       INTERS
      IMPLICIT REAL*8 (A-H,O-Z)                                         INTERS
      DIMENSION A(3,3),B(3,3),XM(3),X(3)                                INTERS
      DIMENSION C(3,4),Z(3),BM(3),AX(3),AM(3)                           INTERS
      EQUIVALENCE (Z(1),C(1,4))                                         INTERS
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         INTERS
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
C                                 INITIALIZATION                        INTERS
C                                     EVALUATE BM,M'AM,M'BM             INTERS
C                                     SET N=0, V=M'BM/M'AM              INTERS
      N = 0                                                             INTERS
      BMM = 0.0                                                         INTERS
      AMM = 0.0                                                         INTERS
      DO 11 I=1,3                                                       INTERS
      BM(I) = 0.0                                                       INTERS
      AM(I) = 0.0                                                       INTERS
      DO 10 J=1,3                                                       INTERS
      IF (DABS(A(I,J)).LT.EPS(20)) A(I,J) = 0.0                         INTERS
      AM(I) = AM(I) + A(I,J)*XM(J)                                      INTERS
      IF (DABS(B(I,J)).LT.EPS(20)) B(I,J) =0.0                          INTERS
   10 BM(I) = BM(I) + B(I,J)*XM(J)                                      INTERS
      BMM = BMM + XM(I)*BM(I)                                           INTERS
   11 AMM = AMM + XM(I)*AM(I)                                           INTERS
      IF (V.EQ.0.0) V=T*DSQRT(BMM/AMM)                                  INTERS
      IDONE = 0                                                         INTERS
C                                 NEWTON-RAPHSON ITERATION FOR          INTERS
C                                 G(V) = FA(V)-FB(V) = 0                INTERS
C                                     SOLVE (VA+B)X = BM  FOR X         INTERS
      ITER = 0                                                          INTERS
   20 ITER = ITER+1                                                     INTERS
      DO 22 I=1,3                                                       INTERS
      DO 21 J=1,3                                                       INTERS
   21 C(I,J) = V*A(I,J) + B(I,J)                                        INTERS
   22 Z(I)   = BM(I)                                                    INTERS
      CALL DSMSOL(C,3,3)                                                INTERS
C                                     EVALUATE AX                       INTERS
```

```
C                                                  FA(V) - X'AX          INTERS
C                                                  FB(V) - -V(X'-M')AX   INTERS
      FA - 0.0                                                           INTERS
      FB - 0.0                                                           INTERS
      CALL MAT31(A,Z,AX)                                                 INTERS
      DO 30 I=1,3                                                        INTERS
      X(I) - Z(I)                                                        INTERS
      FA = FA+X(I)*AX(I)                                                 INTERS
   30 FB = FB+(X(I)-XM(I))*AX(I)                                         INTERS
      FB = -V*FB                                                         INTERS
      IF (T.LT.0.0) FA = 1.0/FA                                          INTERS
      IF (IDONE.EQ.1) GO TO 60                                           INTERS
C                                         TEST FOR INTERSECTION          INTERS
      IF (FA-FB) 32,60,31                                                INTERS
C                                         IF FA>FB>1, NO INTERSECTION    INTERS
   31 IF (T.GT.0.0.AND.FB.LT.1.0) GO TO 40                               INTERS
      IF (T.LT.0.0.AND.FA.GT.1.0) GO TO 40                               INTERS
      IF (N.EQ.0) GO TO 60                                               INTERS
      GO TO 62                                                           INTERS
C                                         IF FA<FB<1 , INTERSECTION      INTERS
   32 IF (T.GT.0.0.AND.FB.LE.1.0) N=1                                    INTERS
      IF (T.LT.0.0.AND.FA.GE.1.0) N=1                                    INTERS
C                                         SOLVE (VA+B)Z = AX  FOR Z      INTERS
   40 DO 42 I=1,3                                                        INTERS
      DO 41 J=1,3                                                        INTERS
   41 C(I,J) - V*A(I,J) + B(I,J)                                         INTERS
   42 Z(I)   - AX(I)                                                     INTERS
      CALL DSMSOL(C,3,3)                                                 INTERS
C                                         F'A(V) - -2X'AZ                INTERS
      CALL MAT31 (A,Z,AX)                                                INTERS
      FPA - X(1)*AX(1)                                                   INTERS
     *    + X(2)*AX(2)                                                   INTERS
     *    + X(3)*AX(3)                                                   INTERS
      FPA = -(FPA+FPA)                                                   INTERS
C                                         DV - -G(V)/G'(V)               INTERS
      DV = 1.0 + V                                                       INTERS
      IF (T.LT.0.0) DV - V-FA**2                                         INTERS
      DV - (FB-FA)/(DV*FPA)                                              INTERS
      IF (ITER.GE.50) GO TO 62                                           INTERS
C                                         TEST FOR CONVERGENCE           INTERS
      IF (T*(V+DV).LE.0.0) DV - -0.5*V                                   INTERS
      V   = V+DV                                                         INTERS
      DV = DABS(DV/V)                                                    INTERS
      IF (DV.LE.EPS(12)) IDONE-1                                         INTERS
      GO TO 20                                                           INTERS
C                                     FA(V) - FB(B), RETURN              INTERS
   60 IF (T.LT.0.0) FA - 1.0/FB                                          INTERS
      T - DSQRT(FA)                                                      INTERS
      IF (FA.GT.1.0) GO TO 61                                            INTERS
      N = 1                                                              INTERS
      GO TO 71                                                           INTERS
   61 IF (N.EQ.0) GO TO 71                                               INTERS
```

```
62 WRITE (6,63)                                          INTERS
63 FORMAT(' INTERS ITERATION DID NOT CONVERGE')          INTERS
71 CONTINUE                                              INTERS
   RETURN                                                INTERS
   END                                                   INTERS
```

```
      SUBROUTINE KINPUT                                                 KINPUT
C                                                 REV IV    07/23/86TWOPI
C     PERFORMS THE FOLLOWING CARD INPUT AFTER CARDS E.1-E.4 (SUBROUTINE KINPUT
C     CINPUT) AND BEFORE CARDS F.1-F.5 (SUBROUTINE FINPUT).             KINPUT
C        CARD E.5 -  NO LONGER REQUIRED                                 WINDOP
C        CARDS E.6 - DEFINITIONS OF WIND FORCE FUNCTIONS AND DRAG       WINDOP
C                    COEFFICIENT FUNCTIONS                              WINDOP
C        CARDS E.7 - DEFINITIONS OF JOINT RESTORING FORCE FUNCTIONS     KINPUT
C                                                                       KINPUT
      IMPLICIT REAL*8(A-H,O-Z)                                          KINPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           KINPUT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         KINPUT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           WINDOP
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       WINDOP
     *               JOINT(30),CGS(30),JS(30)                           WINDOP
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      TGMOD1
      LOGICAL*1 CGS,JS                                                  80386
      COMMON/TEMPVS/ JTITLE(5,51),NF(5),MS(3),KTITLE(31),TH(50)         KINPUT
     *              ,DMMY(34916)                                        80386
C     NOTE: TEMPVS IS SHARED HERE WITH SUBROUTINES CINPUT AND FINPUT.   KINPUT
      REAL BLANK,JTITLE,KTITLE                                          KINPUT
      DATA BLANK/4H    /                                                KINPUT
   11 FORMAT(2I6)                                                       KINPUT
      J1 = MXTB1+1                                                      KINPUT
      IF (NWINDF.LE.0) GO TO 31                                         KINPUT
      DO 30 K=1,NWINDF                                                  KINPUT
C                                                                       KINPUT
C     INPUT CARD E.6.A - FUNCTION NO. AND TITLE                         KINPUT
C                                                                       KINPUT
      READ (5,12) I,(KTITLE(J),J=1,5)                                   KINPUT
   12 FORMAT(I4,4X,5A4)                                                 KINPUT
      WRITE (6,13) I,(KTITLE(J),J=1,5),I,J1,NPG                         PAGE
      NPG=NPG+1                                                         PAGE
   13 FORMAT('1 WIND FORCE FUNCTION NO.',I4,4X,5A4,10X,'NTI(',I2,') =', KINPUT
     *       I5,46X,'PAGE',I5/120X,'CARDS E.6'/)                        PAGE
      IF (I.LE.0.OR.I.GT.50) WRITE (6,14)                               KINPUT
   14 FORMAT('0 IMPROPER FUNCTION NO. PROGRAM TERMINATED.')             KINPUT
      IF (I.LE.0.OR.I.GT.50) STOP 11                                    KINPUT
      IF (NTI(I).NE.0) WRITE (6,15) I                                   KINPUT
   15 FORMAT('0 FUNCTION NO.',I4,' HAS ALREADY BEEN INPUTTED AND WILL BEKINPUT
     * REPLACED BY THIS FUNCTION.')                                     KINPUT
      NTI(I) = J1                                                       KINPUT
      DO 16 J=1,5                                                       KINPUT
   16 JTITLE(J,I) = KTITLE(J)                                           KINPUT
      J2 = J1+4                                                         KINPUT
C                                                                       KINPUT
C     INPUT CARD E.6.B                                                  WINDOP
C                                                                       WINDOP
      READ  (5,60) (TAB(J),J=J1,J2-2),NSV,NSR                           WINDOP
```

```
60    FORMAT(3F12.0,2I12)                                              WINDOP
      TAB(J2-1) = DFLOAT(NSV)                                          WINDOP
      TAB(J2) = DFLOAT(NSR)                                            WINDOP
      IF (TAB(J1).EQ.0.0) GOTO 22                                      WINDOP
      WRITE(6,23) (TAB(J),J=J1,J2-2),NSV,SEG(NSV),NSR,SEG(NSR)         WINDOP
23    FORMAT(' SPEC. HEAT RATIO    SONIC VEL.    ABS. PRESS.',7X,      WINDOP
     *        'SEGMENT    REF. SEGMENT',/3F15.4,2(I11,A4)//)           WINDOP
      J1=J2+1                                                          WINDOP
      GOTO 30                                                          MISC
22    WRITE (6,18) (TAB(J),J=J1,J2)                                    KINPUT
   17 FORMAT(6F12.0)                                                   KINPUT
   18 FORMAT(10X,'D0',13X,'D1',13X,'D2',13X,'D3',8X,'REF. SEGMENT',    WINDOP
     *       /5F15.4//)                                                WINDOP
      J1 = J2+1                                                        KINPUT
C                                                                      KINPUT
C     INPUT CARD E.6.C - NTMPTS                                        KINPUT
C                                                                      KINPUT
      READ  (5,11) NTMPTS                                              KINPUT
      WRITE (6,19) NTMPTS                                              KINPUT
   19 FORMAT('0 WIND FORCE TABLES FOR ',I6,' TIME POINTS.'//           KINPUT
     *        11X,'T',14X,'FX(T)',15X,'FY(T)',15X,'FZ(T)'  /)          KINPUT
      TAB(J1) = NTMPTS                                                 KINPUT
      J1 = J1+1                                                        KINPUT
      J2 = J1+4*NTMPTS-1                                               KINPUT
C                                                                      KINPUT
C     INPUT CARDS E.6.D-E.6.N - NTMPTS CARDS OF T,FX(T),FY(T),FZ(T)    KINPUT
C                                                                      KINPUT
      READ  (5,20) (TAB(J),J=J1,J2)                                    KINPUT
      WRITE (6,21) (TAB(J),J=J1,J2)                                    KINPUT
   20 FORMAT(4F12.0)                                                   KINPUT
   21 FORMAT(3X,F12.6,3G20.6)                                          KINPUT
      J1 = J2+1                                                        KINPUT
   30 CONTINUE                                                         KINPUT
   31 IF (NJNTF.LE.0) GO TO 51                                         KINPUT
      DO 50 K=1,NJNTF                                                  KINPUT
C                                                                      KINPUT
C     INPUT CARD E.7.A - FUNCTION NO. AND TITLE                        KINPUT
C                                                                      KINPUT
      READ  (5,12) I,(KTITLE(J),J=1,5)                                 KINPUT
      WRITE (6,32) I,(KTITLE(J),J=1,5),I,J1,NPG                        PAGE
      NPG=NPG+1                                                        PAGE
   32 FORMAT('1 JOINT FORCE FUNCTION NO.',I4,4X,5A4,10X,'NTI(',I2,') =',KINPUT
     *         I5,45X,'PAGE',I5/120X,'CARDS E.7'/)                     PAGE
      IF (I.LE.0.OR.I.GT.50) WRITE (6,14)                              KINPUT
      IF (I.LE.0.OR.I.GT.50) STOP 12                                   KINPUT
      IF (NTI(I).NE.0) WRITE (6,15) I                                  KINPUT
      NTI(I) = J1                                                      KINPUT
      DO 33 J=1,5                                                      KINPUT
   33 JTITLE(J,I) = KTITLE(J)                                          KINPUT
C                                                                      KINPUT
C     INPUT CARD E.7.B - D0,D1,D2,D3,D4 (FOR NOW A BLANK CARD).        KINPUT
C                                                                      KINPUT
```

```
      J2 = J1+4                                                         KINPUT
      READ  (5,17) (TAB(J),J=J1,J2)                                     KINPUT
      WRITE (6,18) (TAB(J),J=J1,J2)                                     KINPUT
      J1 = J2+1                                                         KINPUT
C                                                                       KINPUT
C     INPUT CARD E.7.C - NTHETA,NPHI                                    KINPUT
C                                                                       KINPUT
      READ  (5,11) NTHETA,NPHI                                          KINPUT
      TAB(J1  ) = NTHETA                                                KINPUT
      TAB(J1+1) = NPHI                                                  KINPUT
      J1 = J1+2                                                         KINPUT
      IF (NTHETA.LT.0) GO TO 38                                         KINPUT
      DO 35 J=1,NTHETA                                                  KINPUT
   35 TH(J) = DFLOAT(J-1)*180.0/DFLOAT(NTHETA-1)                        KINPUT
      WRITE (6,36) NTHETA,NPHI,(TH(J),J=2,NTHETA)                       KINPUT
   36 FORMAT('0 FUNCTION IS TABULAR FOR' ,I3,' X',I3,' VALUES OF THETA AKINPUT
     *ND PHI'//30X,'THETA'/5X,'PHI',5X,'THETA0',F16.3,4F20.3/           KINPUT
     *     (15X,5F20.3))                                                KINPUT
   37 FORMAT(F9.2,F10.3,5G20.7/(19X,5G20.7))                            KINPUT
      GO TO 40                                                          KINPUT
   38 NPOLY = -NTHETA -1                                                KINPUT
      WRITE (6,39) NPOLY,NPHI,(BLANK,J,J=1,NPOLY)                       KINPUT
   39 FORMAT('0 FUNCTION IS COEFFICIENTS OF' ,I3,' ORDER POLYNOMIALS IN KINPUT
     *(THETA-THETA0) FOR',I3,' VALUES OF PHI.'//                        KINPUT
     *  27X,'COEFFICIENTS OF (THETA-THETA0)**N'/                        KINPUT
     *  5X,'PHI',5X,'THETA0',7X,5(A4,'N =',I2,11X)/(26X,A4,'N =',I2,11X,KINPUT
     *  A4,'N =',I2,11X,A4,'N =',I2,11X,A4,'N =',I2,11X,A4,'N =',I2)  ) KINPUT
   40 WRITE (6,21)                                                      KINPUT
      DO 49 I=1,NPHI                                                    KINPUT
      PHIDEG = DFLOAT(I-1)*360.0/DFLOAT(NPHI) - 180.0                   KINPUT
C                                                                       KINPUT
C     INPUT CARDS E.7.D - E.7.N NPHI SETS WITH NTHETA ITEMS PER SET.    KINPUT
C        EACH SET I IS FOR PHI(I) = -180 +(I-1)*360/NPHI DEGREES AND    KINPUT
C        ASSUMES DATA FOR PHI(NPHI+1) = 180 IS SAME AS PHI(1) = -180.   KINPUT
C                                                                       KINPUT
      J2 = J1 + IABS(NTHETA) -1                                         KINPUT
      READ  (5,17) (TAB(J),J=J1,J2)                                     KINPUT
      WRITE (6,37) PHIDEG,(TAB(J),J=J1,J2)                              KINPUT
      IF (NTHETA.LT.0) TAB(J1) = TAB(J1)*RADIAN                         KINPUT
      IF (NTHETA.LT.0) GO TO 49                                         KINPUT
C                                                                       KINPUT
C     FOR TABULAR DATA, FILL IN ZERO VALUES WITH INTERPOLATED NEGATIVE  KINPUT
C     VALUES. OVERWRITE VALUE IN FIRST COLUMN (SUPPLIED AS THETA0) WITH KINPUT
C     VALUE FOR THETA = 0 AND ALL OTHER ZERO VALUES.                    KINPUT
C                                                                       KINPUT
      THETA0 = TAB(J1)                                                  KINPUT
      IF (THETA0.EQ.0.0) GO TO 49                                       KINPUT
      JJ = THETA0*DFLOAT(NTHETA-1)/180.0 + 1.0 + EPS(6)                 KINPUT
      JJ1 = J1+JJ                                                       KINPUT
      IERROR = 0                                                        KINPUT
      IF (JJ1.GT.J2) IERROR = 1                                         KINPUT
      IF (TAB(JJ1).LE.0.0) IERROR = 2                                   KINPUT
```

```
      IF (IERROR.NE.0) GO TO 46                                         KINPUT
      DO 45 J=1,JJ                                                      KINPUT
      J1J = J1+J-1                                                      KINPUT
      IF (J.NE.1.AND.TAB(J1J).GT.0.0) IERROR = 3                        KINPUT
   45 TAB(J1J) = TAB(JJ1)*(TH(J)-THETA0)/(TH(JJ+1)-THETA0)              KINPUT
   46 IF (IERROR.NE.0) WRITE (6,47) IERROR                              KINPUT
   47 FORMAT('0 INPUT ERROR. INCONSISTENT VALUE OF THETA0. IERROR =',I2,KINPUT
     *       ' PROGRAM TERMINATED.')                                    KINPUT
      IF (IERROR.NE.0) STOP 13                                          KINPUT
   49 J1 = J2+1                                                         KINPUT
   50 CONTINUE                                                          KINPUT
   51 MXTB1 = J1-1                                                      KINPUT
      RETURN                                                            KINPUT
      END                                                               KINPUT
```

```
      SUBROUTINE LINAXS(XO,YO,THETA,NINTVS,TOTLGT)                      LINAXS
C                                                    REV 18    02/28/78LINAXS
C     PURPOSE : PREPARE A LINEAR AXIS ON A PLOT.                        LINAXS
C                                                                       LINAXS
C     DESCRIPTION OF PARAMETERS:                                        LINAXS
C        XO,YO - STARTING POINT (IN INCHES, REL TO PLOTTER ORIGIN).     LINAXS
C                                                                       LINAXS
C        THETA - ANGLE OF AXIS, IN DEGREES.                             LINAXS
C                                                                       LINAXS
C        NINTVS- MAGNITUDE - NO. OF INTERVALS DELINEATED BY TIC MARKS.  LINAXS
C              - SIGN DETERMINES WHETHER TIC MARKS ARE PLACED ON        LINAXS
C                POSITIVE OR NEGATIVE SIDE OF AXIS, RESPECTIVELY        LINAXS
C                (POSITIVE SIDE IS TO LEFT OF DIRECTION OF TRAVEL).     LINAXS
C                                                                       LINAXS
C        TOTLGT- TOTAL LENGTH OF AXIS, IN INCHES.                       LINAXS
C                                                                       LINAXS
C     SUBROUTINES REQUIRED : SIN, COS, PLOT (NOTE: SINGLE PRECISION).   LINAXS
C                                                                       LINAXS
C     AUTHOR: W. D. FRYER, CALSPAN (MARCH 1967).                        LINAXS
C                                                                       LINAXS
C     PLAGIARIZED FROM CALSPAN SUBROUTINE LIBRARY (NO. CU 0035).        LINAXS
C                                                                       LINAXS
      THR = 1.7453293E-2 * THETA                                        LINAXS
      SINT = SIN(THR)                                                   LINAXS
      COST = COS(THR)                                                   LINAXS
C                                                                       LINAXS
      DL = ABS(TOTLGT/ FLOAT(NINTVS))                                   LINAXS
      DX = DL*COST                                                      LINAXS
      DY = DL*SINT                                                      LINAXS
C                                                                       LINAXS
      TICX = -0.12* SINT                                                LINAXS
      TICY = 0.12* COST                                                 LINAXS
      IF(NINTVS.GT.0) GO TO 30                                          LINAXS
      TICX = -TICX                                                      LINAXS
      TICY = -TICY                                                      LINAXS
C                                                                       LINAXS
   30 X = XO                                                            LINAXS
      Y = YO                                                            LINAXS
C                                                                       LINAXS
      CALL PLOT (X +TICX,Y+TICY,3)                                      LINAXS
      CALL PLOT (X,Y,2)                                                 LINAXS
      NINT = IABS(NINTVS)                                               LINAXS
      DO 40 I=1,NINT                                                    LINAXS
      X = X+DX                                                          LINAXS
      Y = Y+DY                                                          LINAXS
      CALL PLOT(X,Y,2)                                                  LINAXS
      CALL PLOT(X+TICX,Y+TICY,2)                                        LINAXS
   40 CALL PLOT(X,Y,2)                                                  LINAXS
C                                                                       LINAXS
      RETURN                                                            LINAXS
      END                                                               LINAXS
```

```
      SUBROUTINE LOGAXS(XO,YO,THETA,NDEC,EXTENT)                        LOGAXS
C                                                  REV 19    09/18/79LOGAXS
C     PURPOSE : PREPARE LOGARITHMIC AXIS ON A PLOT.                     LOGAXS
C                                                                       LOGAXS
C     DESCRIPTION OF PARAMETERS:                                        LOGAXS
C                                                                       LOGAXS
C        XO,YO - STARTING POINT (IN INCHES, REL TO PLOTTER ORIGIN).     LOGAXS
C                                                                       LOGAXS
C        THETA - ANGLE OF AXIS (DEGREES).                               LOGAXS
C                                                                       LOGAXS
C        NDECS - MAGNITUDE OF NDECS SPECIFIES NO. OF DECADES.           LOGAXS
C              - SIGN DETERMINES WHETHER TIC MARKS ARE TO BE PLACED     LOGAXS
C                ON POS. OR NEG. SIDE OF AXIS, RESP. (POS. SIDE IS      LOGAXS
C                TO LEFT OF PREDOMINANT DIRECTION OF TRAVEL).           LOGAXS
C                                                                       LOGAXS
C        EXTENT- MAGNITUDE OF EXTENT SETS OVER-ALL LENGTH OF AXIS       LOGAXS
C                IN INCHES. IF EXTENT IS POSITIVE, TIC MARKS ARE        LOGAXS
C                SPACED NORMALLY (LARGE INTERVALS FIRST). IF EXTENT     LOGAXS
C                IS NEGATIVE, TIC MARKS ARE SPACED IN REVERSE ORDER     LOGAXS
C                (SMALL INTERVALS FIRST).                               LOGAXS
C                                                                       LOGAXS
C     SUBROUTINES REQUIRED : SIN, COS, PLOT (NOTE: SINGLE PRECISION).   LOGAXS
C                                                                       LOGAXS
C     AUTHOR: W. D. FRYER, CALSPAN (MARCH 1967).                        LOGAXS
C                                                                       LOGAXS
C     PLAGIARIZED FROM CALSPAN SUBROUTINE LIBRARY (NO. CU 0036).        LOGAXS
C                                                                       LOGAXS
      LOGICAL REVERS                                                    LOGAXS
      REAL XL(18),XLO(19)                                               LOGAXS
      EQUIVALENCE (XLO(2),XL(1))                                        LOGAXS
      DATA XLO/ 0.0    , 0.17609, 0.30103, 0.39794, 0.47712, 0.54407,   LOGAXS
     * 0.60206, 0.65321, 0.69897, 0.74036, 0.77815, 0.81291, 0.84510,   LOGAXS
     * 0.87506, 0.90309, 0.92942, 0.95424, 0.97772, 1.0     /           LOGAXS
      DATA RPD /1.7453293E-2/                                           LOGAXS
C                                                                       LOGAXS
C                                                                       LOGAXS
      REVERS = .FALSE.                                                  LOGAXS
      IF(EXTENT.LT.0.0) REVERS = .TRUE.                                 LOGAXS
C                                                                       LOGAXS
      NODEC = IABS(NDEC)                                                LOGAXS
      SPDEC = ABS(EXTENT) / FLOAT(NODEC)                                LOGAXS
      THR = THETA*RPD                                                   LOGAXS
      COST = COS(THR)                                                   LOGAXS
      SINT = SIN(THR)                                                   LOGAXS
C                                                                       LOGAXS
      TICX1 =-0.05*SINT                                                 LOGAXS
      TICY1 = 0.05*COST                                                 LOGAXS
      TICXA = -0.12*SINT                                                LOGAXS
      TICXB = -0.20*SINT                                                LOGAXS
      TICYA = 0.12*COST                                                 LOGAXS
      TICYB = 0.20*COST                                                 LOGAXS
      IF(NDEC.GT.0) GO TO 50                                            LOGAXS
```

```
C                                                               LOGAXS
      TICX1 = -TICX1                                            LOGAXS
      TICY1 = - TICY1                                           LOGAXS
      TICX2 = -TICX2                                            LOGAXS
      TICXA = - TICXA                                           LOGAXS
      TICYA = -TICYA                                            LOGAXS
      TICXB = -TICXB                                            LOGAXS
      TICYB = - TICYB                                           LOGAXS
C                                                               LOGAXS
   50 COST = COST*SPDEC                                         LOGAXS
      SINT = SINT* SPDEC                                        LOGAXS
      TICX2 = TICXA                                             LOGAXS
      TICY2 = TICYA                                             LOGAXS
C                                                               LOGAXS
      XD = X0                                                   LOGAXS
      YD = Y0                                                   LOGAXS
      ND = 1                                                    LOGAXS
      N = 0                                                     LOGAXS
C                                                               LOGAXS
C     *****GO TO START POS.*****                                LOGAXS
      CALL PLOT(X0+TICXB,Y0+TICYB,3)                            LOGAXS
      CALL PLOT(X0,Y0,2)                                        LOGAXS
C                                                               LOGAXS
   60 N = N+1                                                   LOGAXS
      Q = XL(N)                                                 LOGAXS
      IF(.NOT. REVERS) GO TO 65                                 LOGAXS
      M = 18-N                                                  LOGAXS
      Q = 1.0-XL(M)                                             LOGAXS
   65 X = XD + Q*COST                                           LOGAXS
      Y = YD + Q*SINT                                           LOGAXS
      CALL PLOT(X,Y,2)                                          LOGAXS
      CALL PLOT(X+TICX1,Y+TICY1,2)                              LOGAXS
      CALL PLOT (X,Y,2 )                                        LOGAXS
C                                                               LOGAXS
      N = N+1                                                   LOGAXS
      Q = XL(N)                                                 LOGAXS
      IF(.NOT. REVERS) GO TO 75                                 LOGAXS
      M = 18-N                                                  LOGAXS
      Q = 1.0 - XL(M)                                           LOGAXS
   75 X = XD + Q*COST                                           LOGAXS
      Y = YD + Q*SINT                                           LOGAXS
      CALL PLOT(X,Y,2)                                          LOGAXS
      CALL PLOT (X+TICX2,Y+TICY2,2)                             LOGAXS
      CALL PLOT(X,Y,2)                                          LOGAXS
C                                                               LOGAXS
      IF(N-16) 60,80,100                                        LOGAXS
C                                                               LOGAXS
   80 TICX2 = TICXB                                             LOGAXS
      TICY2 = TICYB                                             LOGAXS
      GO TO 60                                                  LOGAXS
C                                                               LOGAXS
  100 IF(ND .EQ. NODEC) GO TO 200                               LOGAXS
```

```
      TICX2 = TICXA                                                     LOGAXS
      TICY2 = TICYA                                                     LOGAXS
      N = 0                                                             LOGAXS
      XD = X                                                            LOGAXS
      YD = Y                                                            LOGAXS
      ND = ND+1                                                         LOGAXS
      GO TO 60                                                          LOGAXS
C                                                                       LOGAXS
  200 RETURN                                                            LOGAXS
      END                                                               LOGAXS
```

```
      FUNCTION LTIME(N)                                                 LTIME
C                                                REV III.2 08/08/84REVIII
C     TEMPORARY FORTRAN VERSION OF S/370 ASSEMBLER LANGUAGE ROUTINE FROMLTIME
C     CALSPAN LIBRARY THAT MEASURES ELAPSED CPU TIME IN UNITS OF 0.01   LTIME
C     SECONDS. IT SHOULD BE REPLACED WITH AN EQUIVALENT ROUTINE BY THE  LTIME
C     USER TO ENABLE SUBROUTINE ELTIME TO PERFORM ON HIS COMPUTER.      LTIME
C                                                                       LTIME
C     ORIGINAL CALSPAN ROUTINE PERFORMS AS FOLLOWS:                     LTIME
C         IT = LTIME(0) GIVES ELAPSED CPU TIME (INTEGER NUMBER OF 0.01  LTIME
C                       SECOND UNITS) SINCE SUBROUTINE REFERENCE WAS    LTIME
C                       RESET, AND RESETS THIS REFERENCE.               LTIME
C         IT = LTIME(1) SAME, EXCEPT THAT THE REFERENCE IS NOT RESET.   LTIME
C                                                                       LTIME
C                                                                       PECONV
C     THIS SUBROUTINE DOESN'T WORK WITH THE P-E COMPUTER                PECONV
C     BUT THE CODE IS LEFT HERE AS A DUMMY SUBROUTINE.                  PECONV
C     HOWEVER, THERE IS A VERSION OF THIS SUBROUTINE THAT               PECONV
C     CAN BE USED, BUT IT CAN ONLY BE COMPILED WITH THE                 PECONV
C     P-E FORTRAN O COMPILER.  THE OBJECT DECK FOR THIS                 PECONV
C     SUBROUTINE IS KEPT SEPARATELY AND INCLUDED IN THE                 PECONV
C     TASK FILE WHEN THE PROGRAM IS LINKED                              PECONV
C                                                                       PECONV
      DATA KTIME/0/                                                     LTIME
      KTIME = KTIME+1                                                   LTIME
      LTIME = KTIME                                                     LTIME
      IF (N.EQ.0) KTIME = 0                                             LTIME
      RETURN                                                            LTIME
      END                                                               LTIME
```

```
      SUBROUTINE MAT31 (A,B,C)                                          MAT31
C                                                  REV 17    01/03/77MAT31
C     PERFORMS MATRIX MULTIPLICATION C = AB                             MAT31
C     WHERE A IS A 3X3 MATRIX, AND B AND C ARE VECTORS OF LENGTH 3.    MAT31
C                                                                       MAT31
      IMPLICIT REAL*8 (A-H,O-Z)                                         MAT31
      DIMENSION  A(3,3) , B(3) , C(3)                                   MAT31
      C(1) = A(1,1)*B(1) + A(1,2)*B(2) + A(1,3)*B(3)                    MAT31
      C(2) = A(2,1)*B(1) + A(2,2)*B(2) + A(2,3)*B(3)                    MAT31
      C(3) = A(3,1)*B(1) + A(3,2)*B(2) + A(3,3)*B(3)                    MAT31
      RETURN                                                            MAT31
      END                                                               MAT31
```

```
      SUBROUTINE MAT33 (A,B,C)                                          MAT33
C                                                  REV 17     01/03/77MAT33
C     PERFORMS MATRIX MULTIPLICATION C = AB                             MAT33
C     WHERE A, B AND C ARE ALL 3X3 MATRICEES.                           MAT33
C                                                                       MAT33
      IMPLICIT REAL*8 (A-H,O-Z)                                         MAT33
      DIMENSION  A(3,3) , B(3,3) , C(3,3)                               MAT33
      DO  10  I=1,3                                                     MAT33
      DO  10  J=1,3                                                     MAT33
   10 C(I,J) = A(I,1)*B(1,J) + A(I,2)*B(2,J) + A(I,3)*B(3,J)            MAT33
      RETURN                                                            MAT33
      END                                                               MAT33
```

```
      SUBROUTINE ORTHO(P,X,L)                                           ORTHO
C                                                   REV 03    05/31/73ORTHO
C     GENERATES A SET OF RIGHT HANDED ORTHONORMAL VECTORS (P),          ORTHO
C     GIVEN ONE OF THE VECTORS (X), WHERE                               ORTHO
C          P - LX3 MATRIX OF 3 ORTHONORMAL VECTORS TO BE GENERATED.     ORTHO
C          X - GIVEN VECTOR.                                            ORTHO
C          L - 1ST SUBSCRIPT OF P IN CALLING PROGRAM.                   ORTHO
C                                                                       ORTHO
      IMPLICIT REAL*8(A-H,O-Z)                                          ORTHO
      DIMENSION P(L,3),X(3)                                             ORTHO
       M=2                                                              ORTHO
       N=3                                                              ORTHO
       TEST=0.                                                          ORTHO
       DO 5 I=1,3                                                       ORTHO
       P(I,3)=X(I)                                                      ORTHO
       D=1.-X(I)**2                                                     ORTHO
       IF(D.LE.TEST)GO TO 4                                             ORTHO
       TEST=D                                                           ORTHO
       D=DSQRT(D)                                                       ORTHO
       P(I,1)=D                                                         ORTHO
       P(I,2)=0.                                                        ORTHO
       P(M,2)=X(N)/D                                                    ORTHO
       P(N,2)=-X(M)/D                                                   ORTHO
       P(M,1)=X(I)*P(N,2)                                               ORTHO
       P(N,1)=-X(I)*P(M,2)                                              ORTHO
    4  M=N                                                              ORTHO
       N=I                                                              ORTHO
    5  CONTINUE                                                         ORTHO
       RETURN                                                           ORTHO
      END                                                               ORTHO
```

```
      SUBROUTINE OUTPUT(IJK)                                              OUTPUT
C                                                 REV IV    02/01/88MISDOT
C     CONTROLS TABULATED OUTPUT ON FORTRAN UNITS (STARTING WITH NO. 21) OUTPUT
C     OF SELECTED OPTIONAL SEGMENT LINEAR AND ANGULAR ACCELERATIONS,    OUTPUT
C     VELOCITIES AND DISPLACEMENTS, JOINT PARAMETERS AND SELECTED DATA  OUTPUT
C     FROM ALL ALLOWED CONTACT FORCE COMPUTATIONS BETWEEN BODY SEGMENTS OUTPUT
C     AND VEHICLE COMPONENTS.                                           OUTPUT
C                                                                       OUTPUT
      IMPLICIT REAL*8 (A-H,O-Z)                                         OUTPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           OUTPUT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),OUTPUT
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),OUTPUT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       OUTPUT
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     OUTPUT
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    OUTPUT
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), OUTPUT
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), OUTPUT
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               OUTPUT
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           OUTPUT
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       OUTPUT
     *               JOINT(30),CGS(30),JS(30)                           OUTPUT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      OUTPUT
      LOGICAL*1 CGS,JS                                                  OUTPUT
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBST,NSSF,NBGSF         OUTPUT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         OUTPUT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      COMMON/COMAIN/VAR(240),DER(240),DT,HO,HMAX,HMIN,RSTIME,           OUTPUT
     *              ISTEP,NSTEPS,NDINT,NEQ IRSIN,IRSOUT                 OUTPUT
      COMMON/DAMPER/ AFSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)OUTPUT
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       OUTPUT
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          OUTPUT
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         OUTPUT
      COMMON/WINDFR/ WTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),    WINDOP
     *               MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)       WINDOP
      COMMON/TEMPVS/ TDATA(14,65),ACC(7,20),T1(3),T2(3),T3(3),T4(9)     CHGIII
     *                ,T5(3,3),T6(3,3),T7(3),DMMY(34024)                80386
      LOGICAL  LTAPE8 , LTHIST                                          OUTPUT
      DATA LINES/-1/,LPP/45/,NTMAX/65/                                  CHGIII
      DATA KMAX/20/,NMAX/22/,MCGMAX/5/                                  CHGIII
C                                                                       OUTPUT
      IF (IJK.NE.0) GO TO 13                                            OUTPUT
C                                                                       OUTPUT
C     SET ALL FORCE ARRAYS TO ZERO.                                     OUTPUT
C                                                                       OUTPUT
      DO 2 I=1,7                                                        MISDOT
      DO 2 J=1,70                                                       MISDOT
```

```
2     PSF(I,J) = 0.0                                                        MISDOT
      DO 3 I=1,4                                                            MISDOT
      DO 3 J=1,20                                                           MISDOT
3     BSF(I,J) = 0.0                                                        MISDOT
      DO 4 I=1,10                                                           MISDOT
      DO 4 J=1,40                                                           MISDOT
4     SSF(I,J) = 0.0                                                        MISDOT
      DO 5 I=1,3                                                            MISDOT
      DO 5 J=1,20                                                           MISDOT
5     BAGSF(I,J) =0.0                                                       MISDOT
      DO 6 I=1,7                                                            MISDOT
      DO 6 J=1,30                                                           MISDOT
6     PRJNT(I,J) = 0.0                                                      MISDOT
      GO TO 66                                                              OUTPUT
C                                                                           OUTPUT
C     LTHIST = TRUE MEANS PRINT LINE OF TIME HISTORY DATA FOR THIS         OUTPUT
C                         TIME POINT ON EACH OUTPUT UNIT (NT).              OUTPUT
C                                                                           OUTPUT
C     LTAPE8 = TRUE MEANS WRITE TIME HISTORY DATA ON TAPE 8.               OUTPUT
C                                                                           OUTPUT
   13 NPRT4 = NPRT(4) + 4                                                   OUTPUT
      IF  (NPRT4.LE.0 .OR. NPRT4.GT.8)  STOP 37                            OUTPUT
      IF(NPRT(26).EQ.6) GO TO 66                                            TGMOD1
      GO TO  (66,66,66,15,16,17,17,16) , NPRT4                             OUTPUT
   15 LTAPE8 = .FALSE.                                                      OUTSTP
      LTHIST = .TRUE.                                                       TGMOD1
      GO TO 116                                                             TGMOD1
   16 LTHIST = .TRUE.                                                       TGMOD1
      LTAPE8 = .TRUE.                                                       TGMOD1
      GO TO 116                                                             TGMOD1
   17 LTHIST = .FALSE.                                                      TGMOD1
      LTAPE8 = .TRUE.                                                       TGMOD1
      GO TO 217                                                             TGMOD1
  116 TEST = DMOD(TIME,DT)                                                  OUTSTP
      TEST = DMIN1(TEST,DABS(DT-TEST))                                      OUTSTP
      IF ((NPRT(26).EQ.0.OR.NPRT(26).EQ.3).AND.TEST.GE.EPS(8))             TGMOD1
     * LTHIST=.FALSE.                                                       TGMOD1
      IF(.NOT.LTAPE8.AND..NOT.LTHIST) GO TO 66                             FIXTTH
  217 CONTINUE                                                              TGMOD1
      IF(NPRT(26).EQ.4) LTHIST=.FALSE.                                      TGMOD1
      IF(NPRT(26).EQ.5) LTAPE8=.FALSE.                                      TGMOD1
      IF(.NOT.LTAPE8.AND..NOT.LTHIST) GO TO 66                             TGMOD1
      CALL ELTIME (1,8)                                                     OUTPUT
      IF (LINES.GE.0) GO TO 21                                              FIXTTH
      PREVT = -999.0                                                        OUTPUT
      LINES = 0                                                             FIXTTH
      IF  (IRSIN.NE.0)  GO TO 10                                            OUTPUT
C                                                                           OUTPUT
C     1ST TIME IN ROUTINE, READ CARD INPUT FOR OUTPUT CONTROL.              OUTPUT
C                                                                           OUTPUT
C      1. NO. OF POINT TOTAL ACCELERATIONS ,POINT NOS. AND LOCATION        CHGIII
C      2. NO. OF POINT REL. VELOCITIES    ,POINT NOS. AND LOCATION         CHGIII
```

```
C       3. NO. OF POINT REL. LINEAR  DISPLACEMENTS ,POINT NOS. AND LOCATICHGIII
C       4. NO. OF SEGMENT ANGULAR ACCELERATIONS AND SEGMENT NOS.        CHGIII
C       5. NO. OF SEGMENT REL. ANGULAR VELOCITIES    AND SEGMENT NOS.   CHGIII
C       6. NO. OF SEGMENT REL. ANGULAR DISPLACEMENTS AND SEGMENT NOS.   CHGIII
C       7. NO. OF JOINT PARAMETERS AND JOINT NOS.                       OUTPUT
C       8. NO. OF SEGMENT WIND FORCES AND SEGMENT NOS.                  WINDOP
C       9. NO. OF JOINT FORCES AND TORQUE NOS.                          WINDOP
C      10. NO. OF CENTER OF GRAVITY AND RELATED INFORMATION             WINDOP
C                                                                       OUTPUT
      WRITE(6,478)                                                      CHGIII
  478 FORMAT(1X,/,2X,'TABULAR TIME HISTORY CONTROL PARAMETERS')         CHGIII
      WRITE(6,479)                                                      CHGIII
  479 FORMAT(3X,'TYPE  KSG     SELECTED SEGMENTS OR JOINTS')            TTHKREF
      DO 20 K=1,9                                                       WINDOP
C                                                                       OUTPUT
C     INPUT CARDS H.(K).(J) FOR K=1,3                                   OUTPUT
C                                                                       OUTPUT
      IF (K.LE.3) READ (5,18) KSG,KREF(1,K),MSG(1,K),(XSG(I,1,K),I=1,3) TTHKREF
   18 FORMAT (I6,2I3,3F12.6)                                            TTHKREF
      IF (KSG.GT.KMAX) STOP 84                                          CHGIII
      IF (K.GT.3) GO TO 201                                             ATBIII
      IF (KSG.LE.1) READ(5,213) IDUMMY                                  ATBIII
  213 FORMAT(I2)                                                        ATBIII
      IF (KSG.LE.1) GO TO 201                                           ATBIII
      DO 205 J=2,KSG                                                    ATBIII
      READ (5,210) KREF(J,K),MSG(J,K),(XSG(I,J,K),I=1,3)                TTHKREF
  210 FORMAT (I9,I3,3F12.6)                                             TTHKREF
  205 CONTINUE                                                          ATBIII
  201 CONTINUE                                                          ATBIII
C                                                                       OUTPUT
C     INPUT CARDS H.(K)     FOR K=4,9                                   WINDOP
C                                                                       OUTPUT
      IF (K.GT.3) READ (5,19) KSG,(KREF(J,K),MSG(J,K),J=1,KSG)          TTHKREF
   19 FORMAT(I6,22I3/(I9,21I3))                                         TTHKREF
      IF (KSG.GT.KMAX) STOP 85                                          CHGIII
      WRITE (6,78) K,KSG,(MSG(J,K),J=1,KSG)                             TTHKREF
      WRITE (6,81) (KREF(J,K),J=1,KSG)                                  TTHKREF
   78 FORMAT('    H.',I1,1X,I3,3X,20I3)                                 TTHKREF
   81 FORMAT('       REF    ',20I3)                                     TTHKREF
      DO 80 J=1,KSG                                                     TTHKREF
      IF(KREF(J,K).GT.NGRND.OR.KREF(J,K).LT.0) STOP 55                  TTHKREF
   80 CONTINUE                                                          TTHKREF
      IF (K.NE.7 .OR. KSG.EQ.0) GO TO 20                                OUTPUT
      DO 12 J=1,KSG                                                     OUTPUT
      L = MSG(J,K)                                                      OUTPUT
      IF (IABS(IPIN(L)).EQ.4) MSG(J,K) = -L                             OUTPUT
   12 CONTINUE                                                          OUTPUT
   20 NSG(K) = KSG                                                      OUTPUT
C                                                                       ATBIII
C     READ INPUT CARDS H.10                                             WINDOP
C                                                                       ATBIII
      READ (5,111) MCG                                                  ATBIII
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```
  111 FORMAT(I6)                                                        ATBIII
      IF (MCG.GT.MCGMAX) STOP 86                                        CHGIII
      IF (MCG.EQ.0) GO TO 114                                           ATBIII
      DO 113 K=1,MCG                                                    ATBIII
      READ (5,112) M,N,(MCGIN(I+2,K),I=1,N)                             ATBIII
  112 FORMAT (24I3)                                                     ATBIII
      IF (N.GT.NMAX) STOP 87                                            CHGIII
      WRITE (6,117) N,(MCGIN(I+2,K),I=1,N)                              TTHKREF
  117 FORMAT('    H.10',I3,3X,22I3)                                     TTHKREF
      WRITE (6,81) M                                                    TTHKREF
      MCGIN(1,K) = M                                                    ATBIII
  113 MCGIN(2,K) = N                                                    ATBIII
  114 CONTINUE                                                          ATBIII
   10 IF  (.NOT.LTAPE8)  GO TO 21                                       OUTPUT
      WRITE  (8)         NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,NPANEL,     OUTPUT
     *                   MNPL,MNBLT,MNSEG,MNBAG,MPL,MBLT,MSEG,MBAG      OUTPUT
      WRITE  (8)         DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL, OUTPUT
     *                   SEG,JOINT,UNITL,UNITM,UNITT,NSG,MSG,XSG,MCG,   ATBIII
     *                   MCGIN,KREF,NHRNSS,NBLTPH,NPTSPB,NSD,MSDM,MSDN  CHGIII
   21 IF(LTHIST) LINES= LINES + 1                                       FIXTTH
      IF  (MOD(LINES,LPP).EQ.1 .AND. LTHIST)  CALL HEDING (LINES,LPP)   OUTPUT
      NT = 20                                                           OUTPUT
      USEC = 1000.0*TIME                                                OUTPUT
C                                                                       OUTPUT
C     COMPUTE AND PRINT DATA FOR 9 TYPES OF OUTPUT ABOVE                WINDOP
C                                                                       OUTPUT
      DO 44 K=1,9                                                       WINDOP
      IF (NSG(K).LE.0) GO TO 44                                         OUTPUT
      KSG = NSG(K)                                                      OUTPUT
      IF (K.GT.8) GO TO 440                                             WINDOP
      J3  = 3                                                           OUTPUT
      IF (K.EQ.7) J3 = 2                                                OUTPUT
      DO 43 J1=1,KSG,J3                                                 OUTPUT
      J2 = MINO(J1+J3-1,KSG)                                            OUTPUT
      NT =NT + 1                                                        OUTPUT
C     SETUP LOGICAL UNIT CONTROL (FOR PRINTER) FOR PERKIN & ELMER       PECONV
C     CALL CARCON(NT,1)                                                 80386
      DO 38 J=J1,J2                                                     OUTPUT
      L = IABS(MSG(J,K))                                                OUTPUT
      GO TO (22,24,26,29,31,34,35,601),K                                WINDOP
C                                                                       OUTPUT
C     1. POINT TOTAL ACCELERATION IN KREF(1) REFERENCE                  CHGIII
C                                                                       OUTPUT
   22 IF(LPMI(L).EQ.0) GO TO 521                                        CHGIII
      CALL MAT31(LPMI(1,1,L),XSG(1,J,K),T7)                             CHGIII
      GO TO 523                                                         CHGIII
  521 DO 522 JL=1,3                                                     CHGIII
  522 T7(JL) = XSG(JL,J,K)                                              CHGIII
  523 CALL CROSS (WMEG(1,L),T7,T1)                                      CHGIII
      CALL CROSS (WMEG(1,L),T1,T2)                                      OUTPUT
      CALL CROSS (WMEGD(1,L),T7,T3)                                     CHGIII
      CALL MAT31(D(1,1,L),GRAVTY,T7)                                    ACCEL
```

```
      CALL MAT31(D(1,1,L),SEGLA(1,L),T4)                                OUTPUT
      DO 23 I=1,3                                                       OUTPUT
      IF(MSG(J,K).LT.0) T4(I)=T4(I)+T7(I)                               ACCEL
      ACC(I,J) = (T4(I)+T3(I)+T2(I))/G                                  OUTPUT
   23 T1(I) = ACC(I,J)                                                  OUTPUT
      IF(MSG(J,K).GE.0) GO TO 405                                       ACCEL
      KRF=L                                                             ACCEL
      IF(LPMI(KRF).NE.0) CALL DOT31(DPMI(1,1,KRF),T1,ACC(1,J))          ACCEL
      IF(KREF(J,K).EQ.1) GOTO 33                                        ACCEL
      DO 600 II=1,3                                                     ACCEL
  600 ACC(II,J)=ACC(II,J)-GRAVTY(II)/G                                  ACCEL
      GOTO 33                                                           ACCEL
C                                                                       OUTPUT
C     2. POINT REL. VELOCITY IN KREF(2) REFERENCE                       CHGIII
C                                                                       OUTPUT
   24 IF(KREF(J,2).EQ.0) KRF = NVEH                                     TTHKREF
      IF(KREF(J,2).NE.0) KRF = KREF(J,2)                                TTHKREF
      IF(LPMI(L).EQ.0) GO TO 524                                        CHGIII
      CALL MAT31(DPMI(1,1,L),XSG(1,J,K),T7)                             CHGIII
      GO TO 525                                                         CHGIII
  524 DO 526 JL=1,3                                                     CHGIII
  526 T7(JL) = XSG(JL,J,K)                                              CHGIII
  525 CALL CROSS (WMEG(1,L),T7,T1)                                      CHGIII
      CALL DOT31(D(1,1,L),T1,T2)                                        OUTPUT
      DO 25 I=1,3                                                       OUTPUT
   25 T3(I) = T2(I) + SEGLV(I,L) - SEGLV(I,KRF)                         CHGIII
      GO TO 28                                                          OUTPUT
C                                                                       OUTPUT
C     3. POINT REL. LINEAR DISPLACEMENT IN KREF(3) REFERENCE            CHGIII
C                                                                       OUTPUT
   26 IF(KREF(J,3).EQ.0) KRF = NVEH                                     TTHKREF
      IF(KREF(J,3).NE.0) KRF = KREF(J,3)                                TTHKREF
      IF  (LPMI(L).EQ.0)  GO TO 76                                      CHGIII
      CALL DOT33 (DPMI(1,1,L),D(1,1,L),T4)                              OUTPUT
      CALL DOT31 (T4,XSG(1,J,K),T1)                                     OUTPUT
      GO TO 77                                                          OUTPUT
   76 CALL DOT31 (D(1,1,L),XSG(1,J,K),T1)                               OUTPUT
   77 DO 27 I=1,3                                                       OUTPUT
   27 T3(I) = T1(I) + SEGLP(I,L) - SEGLP(I,KRF)                         CHGIII
   28 IF (LPMI(KRF).EQ.0) GO TO 403                                     CHGIII
      CALL DOT33(DPMI(1,1,KRF),D(1,1,KRF),T5)                           CHGIII
      CALL MAT31(T5,T3,ACC(1,J))                                        CHGIII
      GO TO 33                                                          OUTPUT
  403 CALL MAT31(D(1,1,KRF),T3,ACC(1,J))                                CHGIII
   33 ACC(4,J) = DSQRT(ACC(1,J)**2+ACC(2,J)**2+ACC(3,J)**2)             CHGIII
      GO TO 38                                                          CHGIII
C                                                                       OUTPUT
C     4. SEGMENT ANGULAR ACCELERATION IN KREF(4) REFERENCE              CHGIII
C                                                                       OUTPUT
   29 DO 30 I=1,3                                                       OUTPUT
      ACC(I,J) = WMEGD(I,L)/(2.0*PI)                                    OUTPUT
   30 T1(I) = ACC(I,J)                                                  OUTPUT
```

```
  405 CONTINUE                                                    CHGIII
      IF(KREF(J,K).EQ.0) GO TO 401                                TTHKREF
      KRF = KREF(J,K)                                             TTHKREF
      IF(LPMI(KRF).EQ.0) GO TO 402                                CHGIII
      CALL DOT33(DPMI(1,1,KRF),D(1,1,KRF),T5)                     CHGIII
      CALL DOTT33(T5,D(1,1,L),T6)                                 CHGIII
      CALL MAT31(T6,T1,ACC(1,J))                                  CHGIII
      GO TO 33                                                    CHGIII
  402 CALL DOTT33(D(1,1,KRF),D(1,1,L),T6)                         CHGIII
      CALL MAT31(T6,T1,ACC(1,J))                                  CHGIII
      GO TO 33                                                    CHGIII
  401 KRF = L                                                     CHGIII
      IF(LPMI(KRF).NE.0) CALL DOT31(DPMI(1,1,KRF),T1,ACC(1,J))    CHGIII
      GO TO 33                                                    OUTPUT
C                                                                 OUTPUT
C     5. SEGMENT REL. ANGULAR VELOCITY IN KREF(5) REFERENCE       CHGIII
C                                                                 OUTPUT
   31 IF(KREF(J,5).EQ.0) KRF = NVEH                               TTHKREF
      IF(KREF(J,5).NE.0) KRF = KREF(J,5)                          TTHKREF
      CALL DOT31 (D(1,1,L),WMEG(1,L),T1)                          CHGIII
      CALL MAT31 (D(1,1,KRF),T1,T2)                               CHGIII
      DO 32 I=1,3                                                 OUTPUT
      IF (KRF.NE.L) T2(I)=T2(I)-WMEG(I,KRF)                       PLTINC
   32 T3(I) = T2(I)/(2.0*PI)                                      PLTINC
      IF(LPMI(KRF).EQ.0) GO TO 449                                CHGIII
      CALL DOT31(DPMI(1,1,KRF),T3,ACC(1,J))                       CHGIII
      GO TO 483                                                   CHGIII
  449 CONTINUE                                                    CHGIII
      DO 457 KJL=1,3                                              CHGIII
  457 ACC(KJL,J) = T3(KJL)                                        CHGIII
  483 ACC(4,J) = DSQRT(ACC(1,J)**2+ACC(2,J)**2+ACC(3,J)**2)       CHGIII
      GO TO 38                                                    OUTPUT
C                                                                 OUTPUT
C     6. SEGMENT REL. ANGULAR DISPLACEMENT IN KREF(6) REFERENCE   CHGIII
C                                                                 OUTPUT
   34 IF(KREF(J,6).EQ.0) KRF = NVEH                               TTHKREF
      IF(KREF(J,6).NE.0) KRF = KREF(J,6)                          TTHKREF
      IF (LPMI(KRF).EQ.0.AND.LPMI(L).EQ.0) GO TO 36               CHGIII
      IF (LPMI(L).EQ.0) GO TO 435                                 CHGIII
      CALL DOT33(DPMI(1,1,L),D(1,1,L),T4)                         CHGIII
  435 IF (LPMI(KRF).EQ.0) GO TO 436                               CHGIII
      CALL DOT33(DPMI(1,1,KRF),D(1,1,KRF),T5)                     CHGIII
  436 IF (LPMI(L).NE.0) GO TO 438                                 CHGIII
      CALL DOTT33(D(1,1,L),T5,T1)                                 CHGIII
      GO TO 37                                                    CHGIII
  438 IF (LPMI(KRF).NE.0) GO TO 439                               CHGIII
      CALL DOTT33(T4,D(1,1,KRF),T1)                               CHGIII
      GO TO 37                                                    CHGIII
  439 CALL DOTT33(T4,T5,T1)                                       CHGIII
      GO TO 37                                                    CHGIII
   36 CALL DOTT33(D(1,1,L),D(1,1,KRF),T1)                         CHGIII
   37 CALL YPRDEG(T1,ACC(1,J))                                    OUTPUT
```

```
      TRACE = 0.5*(T1(1)+T2(2)+T3(3)-1.0)                               OUTPUT
      IF (TRACE.GT. 1.0) TRACE =  1.0                                   OUTPUT
      IF (TRACE.LT.-1.0) TRACE = -1.0                                   OUTPUT
      ACC(4,J) = DACOS(TRACE)/RADIAN                                    OUTPUT
      GO TO 38                                                          OUTPUT
C                                                                       OUTPUT
C     7. JOINT PARAMETERS                                               OUTPUT
C                                                                       OUTPUT
   35 ACC(1,J) = PRJNT(1,L)                                             OUTPUT
      ACC(2,J) = PRJNT(2,L)/RADIAN                                      OUTPUT
      ACC(3,J) = PRJNT(3,L)/RADIAN                                      OUTPUT
      ACC(4,J) = PRJNT(4,L)/RADIAN                                      OUTPUT
      ACC(5,J) = DSQRT(PRJNT(5,L))                                      OUTPUT
      ACC(6,J) = DSQRT(PRJNT(6,L))                                      OUTPUT
      ACC(7,J) = DSQRT(PRJNT(7,L))                                      OUTPUT
      GOTO 38                                                           WINDOP
C                                                                       WINDOP
C     8. SEGMENT WIND FORCE IN KREF(8) REFERENCE                        WINDOP
C                                                                       WINDOP
  601 IF(KREF(J,8).EQ.0) KRF = NGRND                                    TTHKREF
      IF(KREF(J,8).NE.0) KRF = KREF(J,8)                                TTHKREF
      CALL MAT31 (D(1,1,KRF),WF(1,L),T2)                                WINDOP
      IF(LPMI(KRF).EQ.0) GO TO 602                                      WINDOP
      CALL DOT31(DPMI(1,1,KRF),T2,ACC(1,J))                             WINDOP
      GO TO 604                                                         WINDOP
  602 CONTINUE                                                          WINDOP
      DO 603 KJL=1,3                                                    WINDOP
  603 ACC(KJL,J) = T2(KJL)                                              WINDOP
  604 ACC(4,J) = DSQRT(ACC(1,J)**2+ACC(2,J)**2+ACC(3,J)**2)             WINDOP
   38 CONTINUE                                                          OUTPUT
      IF  (.NOT.LTAPE8)  GO TO 40                                       OUTPUT
      KK = 0                                                            OUTPUT
      I2 = 4                                                            OUTPUT
      IF  (K.EQ.7)  I2 = 7                                              OUTPUT
      DO  39  J=J1,J2                                                   OUTPUT
      DO  39  I=1,I2                                                    OUTPUT
      KK = KK+1                                                         OUTPUT
   39 TDATA(KK,NT-20) = ACC(I,J)                                        OUTPUT
   40 IF  (.NOT.LTHIST)  GO TO 43                                       OUTPUT
      IF (K.LE.6) WRITE (NT,41) USEC,((ACC(I,J),I=1,4),J=J1,J2)         OUTPUT
      IF (K.EQ.8) WRITE (NT,41) USEC,((ACC(I,J),I=1,4),J=J1,J2)         WINDOP
   41 FORMAT(F9.3,3(3X,4F9.3) )                                         OUTPUT
      IF (K.EQ.7) WRITE (NT,42) USEC,((ACC(I,J),I=1,7),J=J1,J2)         OUTPUT
   42 FORMAT(F9.3,2(F5.0,3F9.3,2X,3F9.3))                               OUTPUT
   43 CONTINUE                                                          OUTPUT
      GO TO 44                                                          CHGIII
C                                                                       ATBIII
C     9. JOINT FORCES & TORQUES IN KREF(9) GEOMETRIC COORDINATE SYSTEM  WINDOP
C                                                                       CHGIII
  440 DO 860 L=1,KSG                                                    PLTINC
      KRF = NVEH                                                        PLTINC
      IF(KREF(L,9).NE.0) KRF = KREF(L,9)                                PLTINC
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```
      LL=MSG(L,K)                                                       CHGIII
      IF (LPMI(KRF).EQ.0) GO TO 851                                     CHGIII
      CALL DOT33 (DPMI(1,1,KRF),D(1,1,KRF),T5)                          CHGIII
      CALL MAT31 (T5,F(1,LL),T1)                                        CHGIII
      CALL MAT31 (T5,TQ(1,LL),T2)                                       CHGIII
      DO 852 JJ=1,3                                                     CHGIII
      T1(JJ) = T1(JJ)/100.0                                             CHGIII
  852 T2(JJ) = -T2(JJ)/100.0                                            OUT385
      GO TO 859                                                         CHGIII
  851 CONTINUE                                                          CHGIII
      CALL MAT31 (D(1,1,KRF),F(1,LL),T1)                                CHGIII
      CALL MAT31 (D(1,1,KRF),TQ(1,LL),T2)                               CHGIII
      DO 853 JJ=1,3                                                     CHGIII
      T1(JJ) = T1(JJ)/100.0                                             CHGIII
  853 T2(JJ) = -T2(JJ)/100.0                                            OUT385
  859 NT = NT + 1                                                       CHGIII
C     P & E CARRIAGE CONTROL                                            PECONV
C     CALL CARCON(NT,1)                                                 80386
      IF (.NOT.LTAPE8) GO TO 855                                        CHGIII
      DO 854  JL=1,3                                                    CHGIII
      TDATA (JL  ,NT-20) = T1(JL)                                       CHGIII
  854 TDATA (JL+3,NT-20) = T2(JL)                                       CHGIII
  855 CONTINUE                                                          CHGIII
      IF (LTHIST) WRITE (NT,857) USEC,T1,T2                             CHGIII
  857 FORMAT(F9.3,3X,3F9.3,3X,3(2X,D10.3))                              CHGIII
  860 CONTINUE                                                          CHGIII
   44 CONTINUE                                                          CHGIII
C                                                                       ATBIII
C     10.  PRINT BODY PROPERTIES                                        WINDOP
C                                                                       ATBIII
      IF (MCG.EQ.0) GO TO 131                                           ATBIII
      DO 130 NCG=1,MCG                                                  ATBIII
      M = MCGIN(1,NCG)                                                  ATBIII
      N = MCGIN(2,NCG)                                                  ATBIII
      DO 120 J=1,9                                                      ATBIII
  120 T4(J) = 0.0                                                       ATBIII
      SUMW = 0.0                                                        ATBIII
      T7(1)=0.0                                                         KINETIC
      T7(2)=0.0                                                         KINETIC
      DO 123 I=1,N                                                      ATBIII
      K = MCGIN(I+2,NCG)                                                ATBIII
      WG = W(K)/G                                                       ATBIII
      V=(SEGLV(1,K)-SEGLV(1,M))**2                                      KINETIC
     * +(SEGLV(2,K)-SEGLV(2,M))**2                                      KINETIC
     * +(SEGLV(3,K)-SEGLV(3,M))**2                                      KINETIC
      T7(1)=T7(1)+0.5*WG*V                                              KINETIC
      SUMW = SUMW + WG                                                  ATBIII
      DO 121 J=1,3                                                      ATBIII
      T7(2)=T7(2)+0.5*PHI(J,K)*(WMEG(J,K)-WMEG(J,M))**2                 KINETIC
  121 T1(J) = PHI(J,K)*WMEG(J,K)                                        ATBIII
      CALL DOT31 (D(1,1,K),T1,T2)                                       ATBIII
      CALL CROSS (SEGLP(1,K),SEGLV(1,K),T1)                             ATBIII
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      DO 122 J=1,3                                                  ATBIII
      T4(J  ) = T4(J  ) + WG*SEGLP(J,K)                             ATBIII
      T4(J+3) = T4(J+3) + WG*SEGLV(J,K)                             ATBIII
  122 T4(J+6) = T4(J+6) + WG*T1(J) + T2(J)                          ATBIII
  123 CONTINUE                                                      ATBIII
      T7(3)=T7(1)+T7(2)                                             KINETIC
      DO 124 J=1,3                                                  ATBIII
  124 T4(J) = T4(J)/SUMW - SEGLP(J,M)                               ATBIII
C                                                                   ATBIII
C     TRANSFORM FROM PRINCIPAL AXES TO LOCAL AXES                   TGMOD1
C                                                                   ATBIII
      IF (LPMI(M).EQ.0) GO TO 330                                   ATBIII
      CALL DOT33(DPMI(1,1,M),D(1,1,M),T5)                           ATBIII
      CALL MAT31(T5,T4(1),T1)                                       ATBIII
      CALL MAT31(T5,T4(4),T2)                                       ATBIII
      CALL MAT31(T5,T4(7),T3)                                       ATBIII
      GO TO 333                                                     ATBIII
  330 CONTINUE                                                      ATBIII
      CALL MAT31 (D(1,1,M),T4(1),T1)                                ATBIII
      CALL MAT31 (D(1,1,M),T4(4),T2)                                ATBIII
      CALL MAT31 (D(1,1,M),T4(7),T3)                                ATBIII
  333 CONTINUE                                                      ATBIII
      NT = NT + 1                                                   ATBIII
      IF (.NOT.LTAPE8) GO TO 126                                    ATBIII
      DO 125 J=1,3                                                  ATBIII
      TDATA (J  ,NT-20) = T1(J)                                     ATBIII
      TDATA (J+3,NT-20) = T2(J)                                     ATBIII
      TDATA(J+9,NT-20) = T7(J)                                      KINETIC
  125 TDATA(J+6,NT-20) = T3(J)                                      ATBIII
  126 IF (LTHIST) WRITE (NT,127) USEC,T1,T2,T3,T7                   KINETIC
  127 FORMAT (F9.3,3F8.3,9(1X,D10.3))                               KINETIC
  130 CONTINUE                                                      ATBIII
  131 CONTINUE                                                      ATBIII
C                                                                   OUTPUT
C     PRINT PLANE FORCES                                            OUTPUT
C                                                                   OUTPUT
      MPSF = 0                                                      OUTPUT
      IF  (NPL.EQ.0)  GO TO 49                                      OUTPUT
      IF (NPRT(18).EQ.1.OR.NPRT(18).EQ.7) GO TO 49                  VARTTH
      IF (NPRT(18).EQ.10.OR.NPRT(18).EQ.11) GO TO 49                VARTTH
      IF (NPRT(18).GE.14) GO TO 49                                  VARTTH
      DO  45  J=1,NPL                                               OUTPUT
   45 MPSF = MPSF + MNPL(J)                                         OUTPUT
      IF  (MPSF.EQ.0)  GO TO 49                                     OUTPUT
      DO 47 J1=1,MPSF,2                                             OUTPUT
      J2 = MIN0(J1+1,MPSF)                                          OUTPUT
      NT = NT+1                                                     OUTPUT
C     SETUP LOGICAL UNIT CONTROL (PRINTER CONTROL) FOR P & E        PECONV
C     CALL CARCON(NT,1)                                             80386
      IF  (.NOT.LTAPE8)  GO TO 47                                   OUTPUT
      KK = 0                                                        OUTPUT
      DO  46  J=J1,J2                                               OUTPUT
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      DO  46  I=1,7                                                   OUTPUT
      KK = KK+1                                                       OUTPUT
   46 TDATA(KK,NT-20) = PSF(I,J)                                      OUTPUT
   47 IF  (LTHIST)  WRITE (NT,48) USEC,((PSF(I,J),I=1,7),J=J1,J2)     OUTPUT
   48 FORMAT(F9.3,2(F9.3,3F9.2,3F8.3) )                               OUTPUT
C                                                                     OUTPUT
C     PRINT BELT FORCES                                               OUTPUT
C                                                                     OUTPUT
   49 MBSF = 0                                                        OUTPUT
      IF  (NBLT.EQ.0)  GO TO 67                                       OUTPUT
      IF (NPRT(18).EQ.2.OR.NPRT(18).GE.13) GO TO 67                   VARTTH
      IF (NPRT(18).GE.7.AND.NPRT(18).LE.9) GO TO 67                   VARTTH
      DO  50  J=1,NBLT                                                OUTPUT
   50 MBSF = MBSF + MNBLT(J)                                          OUTPUT
      IF  (MBSF.EQ.0)  GO TO 67                                       OUTPUT
      DO 52 J1=1,MBSF,2                                               OUTPUT
      J2 = MIN0(J1+1,MBSF)                                            OUTPUT
      NT = NT+1                                                       OUTPUT
C     LOGICAL UNIT (PRINTER CONTROL) FOR P & E                        PECONV
C     CALL CARCON(NT,1)                                               80386
      IF  (.NOT.LTAPE8)  GO TO 52                                     OUTPUT
      KK = 0                                                          OUTPUT
      DO  51  J=J1,J2                                                 OUTPUT
      DO  51  I=1,4                                                   OUTPUT
      KK = KK+1                                                       OUTPUT
   51 TDATA(KK,NT-20) = BSF(I,J)                                      OUTPUT
   52 IF  (LTHIST)  WRITE (NT,53) USEC,((BSF(I,J),I=1,4),J=J1,J2)     OUTPUT
   53 FORMAT(F9.3,4(F15.6,F12.2,3X) )                                 OUTPUT
C                                                                     OUTPUT
C     PRINT HARNESS-BELT ENDPOINT FORCES (STORED IN BSF ARRAY).       OUTPUT
C                                                                     OUTPUT
   67 IF  (NHRNSS.LE.0)  GO TO 71                                     OUTPUT
      IF (NPRT(18).EQ.3.OR.NPRT(18).EQ.11) GO TO 71                   VARTTH
      IF (NPRT(18).EQ.9.OR.NPRT(18).EQ.8) GO TO 71                    VARTTH
      IF (NPRT(18).EQ.13.OR.NPRT(18).EQ.14) GO TO 71                  VARTTH
      IF (NPRT(18).GE.16) GO TO 71                                    VARTTH
      MBSF1 = MBSF + 1                                                OUTPUT
      DO  68  I=1,NHRNSS                                              OUTPUT
   68 MBSF = MBSF + NBLTPH(I)                                         OUTPUT
      DO  70  J1=MBSF1,MBSF,2                                         OUTPUT
      J2 = MIN0(J1+1,MBSF)                                            OUTPUT
      NT = NT+1                                                       OUTPUT
C     LOGICAL UNIT (PRINTER CONTROL) FOR P & E                        PECONV
C     CALL CARCON(NT,1)                                               80386
      IF  (.NOT.LTAPE8)  GO TO 70                                     OUTPUT
      KK = 0                                                          OUTPUT
      DO  69  J=J1,J2                                                 OUTPUT
      DO  69  I=1,4                                                   OUTPUT
      KK = KK+1                                                       OUTPUT
   69 TDATA(KK,NT-20) = BSF(I,J)                                      OUTPUT
   70 IF  (LTHIST)  WRITE (NT,53) USEC,((BSF(I,J),I=1,4),J=J1,J2)     OUTPUT
C                                                                     OUTPUT
```

```
C     PRINT SPRING DAMPER FORCES (STORED IN BSF ARRAY).                 OUTPUT
C                                                                       OUTPUT
   71 IF  (NSD.LE.0)  GO TO 54                                          OUTPUT
      IF (NPRT(18).EQ.4.OR.NPRT(18).EQ.9) GO TO 54                      VARTTH
      IF (NPRT(18).GE.12) GO TO 54                                      VARTTH
      MBSF1 = MBSF + 1                                                  OUTPUT
      MBSF = MBSF + (NSD: )/2                                           OUTPUT
      DO  73  J1=MBSF1,MBSF,2                                           OUTPUT
      J2 = MIN0(J1+1,MBSF)                                              OUTPUT
      NT = NT+1                                                         OUTPUT
C     LOGICAL UNIT (PRINTER CONTROL) FOR P & E                          PECONV
C     CALL CARCON(NT,1)                                                 80386
      IF  (.NOT.LTAPE8)  GO TO 73                                       OUTPUT
      KK = 0                                                            OUTPUT
      DO  72  J=J1,J2                                                   OUTPUT
      DO  72  I=1,4                                                     OUTPUT
      KK = KK+1                                                         OUTPUT
   72 TDATA(KK,NT-20) = BSF(I,J)                                        OUTPUT
   73 IF  (LTHIST)  WRITE (NT,74) USEC,((BSF(I,J),I=1,4),J=J1,J2)       OUTPUT
   74 FORMAT (F9.3,4(F14.3,F12.2,4X))                                   OUTPUT
C                                                                       OUTPUT
C     PRINT SEGMENT CONTACT FORCES                                      OUTPUT
C                                                                       OUTPUT
   54 MSSF = 0                                                          OUTPUT
      IF (NPRT(18).EQ.5.OR.NPRT(18).EQ.13) GO TO 161                    VARTTH
      IF (NPRT(18).EQ.10.OR.NPRT(18).EQ.11) GO TO 161                   VARTTH
      IF (NPRT(18).GE.15) GO TO 161                                     VARTTH
      DO  55  J=1,NSEG                                                  OUTPUT
   55 MSSF = MSSF + MNSEG(J)                                            OUTPUT
      IF  (MSSF.EQ.0)  GO TO 59                                         OUTPUT
      DO 57 J=1,MSSF                                                    OUTPUT
      NT = NT+1                                                         OUTPUT
C     LOGICAL UNIT (PRINTER CONTROL) FOR P & E                          PECONV
C     CALL CARCON(NT,1)                                                 80386
      IF  (.NOT.LTAPE8)  GO TO 57                                       OUTPUT
      DO  56  I=1,10                                                    OUTPUT
   56 TDATA(I,NT-20) = SSF(I,J)                                         OUTPUT
   57 IF  (LTHIST)  WRITE (NT,58) USEC,(SSF(I,J),I=1,10)                OUTPUT
   58 FORMAT(2F9.3,3F9.2,3F8.3,2X,3F8.3)                                OUTPUT
  161 CONTINUE                                                          VARTTH
C                                                                       OUTPUT
C     PRINT AIRBAG FORCES                                               OUTPUT
C                                                                       OUTPUT
   59 IF (NBAG.EQ.0) GO TO 65                                           OUTPUT
      IF (NPRT(18).EQ.6.OR.NPRT(18).EQ.9) GO TO 65                      VARTTH
      IF (NPRT(18).GE.12) GO TO 65                                      VARTTH
      K1 = 1                                                            OUTPUT
      DO 64 J=1,NBAG                                                    OUTPUT
      IF (MNBAG(J).EQ.0) GO TO 64                                       OUTPUT
      KBAG = MNBAG(J)+NPANEL(J)+5                                       OUTPUT
      DO 63 J1=1,KBAG,4                                                 OUTPUT
      J2 = MIN0(J1+3,KBAG)                                              OUTPUT
```

```
      K2 = K1+J2-J1                                                      OUTPUT
      NT = NT+1                                                          OUTPUT
C     LOGICAL UNIT (PRINTER CONTROL) FOR P & E                           PECONV
C     CALL CARCON(NT,1)                                                  80386
      IF  (.NOT.LTAPE8)  GO TO 61                                        OUTPUT
      KK = 0                                                             OUTPUT
      DO  60  K=K1,K2                                                    OUTPUT
      DO  60  I=1,3                                                      OUTPUT
      KK = KK+1                                                          OUTPUT
   60 TDATA(KK,NT-20) = BAGSF(I,K)                                       OUTPUT
   61 IF  (.NOT.LTHIST)  GO TO 63                                        OUTPUT
      IF  (J1.EQ.1)  WRITE (NT,75) USEC,((BAGSF(I,K),I=1,3),K=K1,K2)     OUTPUT
      IF  (J1.NE.1)  WRITE (NT,62) USEC,((BAGSF(I,K),I=1,3),K=K1,K2)     OUTPUT
   75 FORMAT (F9.3,3X,3F9.2,2(3X,3F9.3),3X,3F9.2)                        OUTPUT
   62 FORMAT(F9.3,4(3X,3F9.2))                                           OUTPUT
   63 K1 = K2+1                                                          OUTPUT
   64 CONTINUE                                                           OUTPUT
   65 NT = NT-20                                                         OUTPUT
      IF(NT.GT.NTMAX) STOP 56                                            CHGIII
      IF  (LTAPE8)  WRITE (8) NT,USEC,((TDATA(I,J),I=1,14),J=1,NT)       OUTPUT
      PREVT = TIME                                                       OUTPUT
      CALL ELTIME(2,8)                                                   OUTPUT
   66 RETURN                                                             OUTPUT
      END                                                                OUTPUT
```

```
      SUBROUTINE PANEL (DRR,ZR,JB)                                      PANEL
C                                                   REV III.2 08/08/84REVIII
C     COMPUTES AIRBAG PARAMETERS DURING INFLATION OF BAG.               PANEL
C                                                                       PANEL
C        GIVEN: DRR - DC MATRIX RELATIVE TO VEHICLE                     PANEL
C               ZR - CG LOCATION IN VEHICLE REFERENCE                   PANEL
C                                                                       PANEL
C       COMPUTE: SEGLP,SEGLV,SEGLA,D,WMEG & WMEGD FOR SEGMENT JB.       PANEL
C                                                                       PANEL
      IMPLICIT REAL*8 (A-H,O-Z)                                         PANEL
      DIMENSION DRR(3,3),ZR(3),T1(3),T2(3)                              PANEL
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           PANEL
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),PANEL
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       PANEL
      CALL MAT33 (DRR,D(1,1,NVEH),D(1,1,JB))                            PANEL
      CALL MAT31 (DRR,WMEG(1,NVEH),WMEG(1,JB))                          PANEL
      CALL DOT31 (D(1,1,NVEH),ZR,SEGLP(1,JB))                           PANEL
      CALL CROSS (WMEG(1,NVEH),ZR,T1)                                   PANEL
      CALL DOT31 (D(1,1,NVEH),T1,SEGLV(1,JB))                           PANEL
      CALL CROSS (WMEG(1,NVEH),T1,T2)                                   PANEL
      CALL DOT31 (D(1,1,NVEH),T2,SEGLA(1,JB))                           PANEL
      DO  10  I=1,3                                                     PANEL
      SEGLP(I,JB) = SEGLP(I,JB) + SEGLP(I,NVEH)                         PANEL
      SEGLV(I,JB) = SEGLV(I,JB) + SEGLV(I,NVEH)                         PANEL
      SEGLA(I,JB) = SEGLA(I,JB) + SEGLA(I,NVEH)                         PANEL
   10 WMEGD(I,JB) = WMEGD(I,NVEH)                                       PANEL
      RETURN                                                            PANEL
      END                                                               PANEL
```

```
      SUBROUTINE PDAUX (VAR,DER,NEQ,KDINT)                              PDAUX
C                                              REV IV    07/24/86SLIP
C     PURPOSE IS TO ACT AS INTERFACE BETWEEN INTEGRATOR AND DAUX TO     PDAUX
C     ACCOMODATE VARIABLE NUMBER OF FUNCTIONS TO BE INTEGRATED.         PDAUX
C                                                                       PDAUX
C     ARGUMENTS:                                                        PDAUX
C        VAR - ARRAY OF NEQ STATE VARIABLES UPDATED BY DINT.            PDAUX
C        DER - ARRAY OF NEQ DERIVATIVES TO BE SUPPLIED BY DAUX.         PDAUX
C        NEQ - NUMBER OF STATE VARIABLES AND DERIVATIVES.               PDAUX
C      KDINT - INTEGRATION STEP NUMBER IN DINT.                         PDAUX
C                                                                       PDAUX
      IMPLICIT REAL*8 (A-H,O-Z)                                         PDAUX
      DIMENSION VAR(3,1),DER(3,1)                                       PDAUX
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           PDAUX
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),PDAUX
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       PDAUX
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     PDAUX
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    PDAUX
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           PDAUX
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       PDAUX
     *               JOINT(30),CGS(30),JS(30)                           PDAUX
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      PDAUX
      LOGICAL*1 CGS,JS                                                  PDAUX
      COMMON/INTEST/ SGTEST(3,4,30),XTEST(3,120),SEGT(120),REGT(120)    PDAUX
      REAL     SEGT                                                     PDAUX
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          PDAUX
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       SLIP
     *               FE(3,30),TQE(3,30),CONST(5,30)                     SLIP
      COMMON/TEMPVS/ T(3,30),VXT(3),DMMY(35020)                         80386
      DIMENSION SD(3,3,30) , E1(30) , NTST(30) , LSEG(30) , RGTTL(4)    PDAUX
      LOGICAL  LSEG                                                     PDAUX
      DATA NTST/30*0/                                                   PDAUX
      DATA RGTTL/8HANG VEL ,8HLIN VEL ,8HANG ACC ,8HLIN ACC /           PDAUX
      CALL ELTIME(1,6)                                                  PDAUX
      MBAG = NGRND                                                      PDAUX
      IF (NTST(1).NE.0) GO TO 10                                        PDAUX
      LSEG(1) = .FALSE.                                                 VAXCHG
      NTST(1) = 1                                                       ATBIII
      DO 5 M=2,MBAG                                                     ATBIII
      LSEG(M) = ISING(M).GE.0 .AND. JNT(M-1).NE.0                       ATBIII
      IF (IABS(IPIN(M-1)).GE.5.AND.IEULER(M-1).GE.0) LSEG(M)=.FALSE.    SLIP
    5 NTST(M) = M                                                       PDAUX
      NTST(NGRND) = -NGRND                                              PDAUX
      LSEG(NGRND) = .TRUE.                                              PDAUX
      IF (NFLX.EQ.0) GO TO 10                                           PDAUX
      DO 6 J=1,NFLX                                                     PDAUX
      M = NFLEX(2,J)                                                    PDAUX
    6 NTST(M) = -M                                                      PDAUX
   10 IF  (KDINT.EQ.4)  GO TO 48                                        PDAUX
      IF  (KDINT.GT.0)  GO TO 20                                        PDAUX
```

```
C                                                                       PDAUX
C     KDINT=0 IMPLIES INITIAL CALL FROM DINT. PDAUX TO SUPPLY INITIAL   PDAUX
C     VALUES TO STATE VARIABLES AND COMPUTE VALUE OF NEQ.               PDAUX
C                                                                       PDAUX
C                                                                       PDAUX
C       (A) SET Q TO IDENTITY QUATERNION                                PDAUX
C                                                                       PDAUX
      N = 0                                                             PDAUX
      DO 12 M=1,MBAG                                                    PDAUX
      IF (NTST(M).LT.0) GO TO 12                                        PDAUX
      N = N+1                                                           PDAUX
      REGT(N) = RGTTL(1)                                                PDAUX
      SEGT(N) = SEG(M)                                                  PDAUX
      E1(N) = 1.0                                                       PDAUX
      DO 11 I=1,3                                                       PDAUX
      XTEST(I,N) = SGTEST(I,1,M)**2                                     PDAUX
   11 VAR(I,N) = 0.0                                                    PDAUX
   12 CONTINUE                                                          PDAUX
C                                                                       PDAUX
C       (B) SEGLP OF REFERENCE SEGMENTS                                 PDAUX
C                                                                       PDAUX
      DO 14 M=1,MBAG                                                    PDAUX
      IF  (LSEG(M))  GO TO 14                                           PDAUX
      N = N+1                                                           PDAUX
      REGT(N) = RGTTL(2)                                                PDAUX
      SEGT(N) = SEG(M)                                                  PDAUX
      DO 13 I=1,3                                                       PDAUX
      XTEST(I,N) = SGTEST(I,2,M)**2                                     PDAUX
   13 VAR(I,N) = SEGLP(I,M)                                             PDAUX
   14 CONTINUE                                                          PDAUX
C                                                                       PDAUX
C       (C) WMEG                                                        PDAUX
C                                                                       PDAUX
      DO 16 M=1,MBAG                                                    PDAUX
      IF (NTST(M).LT.0) GO TO 16                                        PDAUX
      N = N+1                                                           PDAUX
      REGT(N) = RGTTL(3)                                                PDAUX
      SEGT(N) = SEG(M)                                                  PDAUX
      DO 15 I=1,3                                                       PDAUX
      XTEST(I,N) = SGTEST(I,3,M)**2                                     PDAUX
   15 VAR(I,N) = WMEG(I,M)                                              PDAUX
   16 CONTINUE                                                          PDAUX
C                                                                       PDAUX
C       (D) SEGLV OF REFERENCE SEGMENTS                                 PDAUX
C                                                                       PDAUX
      DO 18 M=1,MBAG                                                    PDAUX
      IF  (LSEG(M))  GO TO 18                                           PDAUX
      N = N+1                                                           PDAUX
      REGT(N) = RGTTL(4)                                                PDAUX
      SEGT(N) = SEG(M)                                                  PDAUX
      DO 17 I=1,3                                                       PDAUX
      XTEST(I,N) = SGTEST(I,4,M)**2                                     PDAUX
```

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   17 VAR(I,N) = SEGLV(I,M)                                                PDAUX
   18 CONTINUE                                                             PDAUX
      NEQ = 3*N                                                            PDAUX
      GO TO 40                                                             PDAUX
   20 IF (KDINT.NE.1) GO TO 30                                             PDAUX
C                                                                          PDAUX
C     KDINT = 1, 1ST STEP IN ADVANCING INTEGRATING INTERVAL,               PDAUX
C                    SAVE DC MATRICES IF TIME HAS ADVANCED.                PDAUX
C                                                                          PDAUX
      N = 0                                                                PDAUX
      DO 22 M=1,MBAG                                                       PDAUX
      IF (NTST(M).LT.0) GO TO 22                                           PDAUX
      N = N+1                                                              PDAUX
      DO 21 J=1,3                                                          PDAUX
      DO 21 I=1,3                                                          PDAUX
   21 SD(I,J,N) = D(I,J,M)                                                 PDAUX
   22 CONTINUE                                                             PDAUX
C                                                                          PDAUX
C     KDINT > 0,1 - FETCH SAVED DC MATRICES AND UPDATE BY CURRENT THETA.PDAUX
C                                                                          PDAUX
C       (A) UPDATE D BY Q                                                  PDAUX
C                                                                          PDAUX
   30 N = 0                                                                PDAUX
      DO 32 M=1,MBAG                                                       PDAUX
      IF (NTST(M).LT.0) GO TO 32                                           PDAUX
      N = N+1                                                              PDAUX
      EDOTE = VAR(1,N)**2 + VAR(2,N)**2 + VAR(3,N)**2                      PDAUX
      IF (EDOTE.GE.1.0) KDINT = -KDINT                                     PDAUX
      IF (KDINT.LE.0)  GO TO 99                                            PDAUX
      E1(N) = DSQRT(1.0-EDOTE)                                             PDAUX
      CALL DSETQ(SD(1,1,N),VAR(1,N),EDOTE,E1(N),D(1,1,M))                  PDAUX
   32 CONTINUE                                                             PDAUX
C                                                                          PDAUX
C     KDINT > 0 - STORE STATE VARIABLES INTO PROGRAM ARRAYS.               PDAUX
C                                                                          PDAUX
C       (B) SEGLP OF REFERENCE SEGMENTS                                    PDAUX
C                                                                          PDAUX
      DO 35 M=1,MBAG                                                       PDAUX
      IF  (LSEG(M))  GO TO 35                                              PDAUX
      N = N+1                                                              PDAUX
      DO 34 I=1,3                                                          PDAUX
   34 SEGLP(I,M) = VAR(I,N)                                                PDAUX
   35 CONTINUE                                                             PDAUX
C                                                                          PDAUX
C       (C) WMEG                                                           PDAUX
C                                                                          PDAUX
      DO 31 M=1,MBAG                                                       PDAUX
      IF (NTST(M).LT.0) GO TO 31                                           PDAUX
      N = N+1                                                              PDAUX
      DO 36 I=1,3                                                          PDAUX
   36 WMEG(I,M) = VAR(I,N)                                                 PDAUX
   31 CONTINUE                                                             PDAUX
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C                                                                       PDAUX
C        (D) SEGLV OF REFERENCE SEGMENTS                                PDAUX
C                                                                       PDAUX
      DO 38 M=1,MBAG                                                    PDAUX
      IF  (LSEG(M))  GO TO 38                                           PDAUX
      N = N+1                                                           PDAUX
      DO 37 I=1,3                                                       PDAUX
   37 SEGLV(I,M) = VAR(I,N)                                             PDAUX
   38 CONTINUE                                                          PDAUX
C                                                                       PDAUX
C     CALL DAUX ROUTINE TO COMPUTE DERIVATIVES                          PDAUX
C                                                                       PDAUX
   40 CALL DAUX(0)                                                      PDAUX
C                                                                       PDAUX
C     STORE DERIVATIVES FOR INTEGRATING SUBROUTINE.                     PDAUX
C                                                                       PDAUX
C        (A) DERIVATIVE OF Q                                            PDAUX
C                                                                       PDAUX
      N = 0                                                             PDAUX
      DO 39 M=1,MBAG                                                    PDAUX
      IF (NTST(M).LT.0) GO TO 39                                        PDAUX
      N = N+1                                                           PDAUX
      CALL CROSS(VAR(1,N),WMEG(1,M),VXT)                                PDAUX
      DO 41 I=1,3                                                       PDAUX
   41 DER(I,N) = 0.5*(E1(N)*WMEG(I,M) + VXT(I) )                        PDAUX
   39 CONTINUE                                                          PDAUX
      NQUAT = N                                                         PDAUX
C                                                                       PDAUX
C        (B) SEGLV OF REFERENCE SEGMENTS                                PDAUX
C                                                                       PDAUX
      DO 43 M=1,MBAG                                                    PDAUX
      IF  (LSEG(M))  GO TO 43                                           PDAUX
      N = N+1                                                           PDAUX
      DO 42 I=1,3                                                       PDAUX
   42 DER(I,N) = SEGLV(I,M)                                             PDAUX
   43 CONTINUE                                                          PDAUX
C                                                                       PDAUX
C        (C) WMEGD                                                      PDAUX
C                                                                       PDAUX
      DO 47 M=1,MBAG                                                    PDAUX
      IF (NTST(M).LT.0) GO TO 47                                        PDAUX
      N = N+1                                                           PDAUX
      DO 44 I=1,3                                                       PDAUX
   44 DER(I,N) = WMEGD(I,M)                                             PDAUX
   47 CONTINUE                                                          PDAUX
C                                                                       PDAUX
C        (D) SEGLA OF REFERENCE SEGMENTS                                PDAUX
C                                                                       PDAUX
      DO 46 M=1,MBAG                                                    PDAUX
      IF  (LSEG(M))  GO TO 46                                           PDAUX
      N = N+1                                                           PDAUX
      DO 45 I=1,3                                                       PDAUX
```

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45 DER(I,N) = SEGLA(I,M)                                    PDAUX
46 CONTINUE                                                 PDAUX
   IF (KDINT.NE.4) GO TO 99                                 PDAUX
48 N = 0                                                    PDAUX
   DO 51 M=1,MBAG                                           PDAUX
   IF (NTST(M).LT.0) GO TO 51                               PDAUX
   N = N+1                                                  PDAUX
   E1(N) = 1.0                                              PDAUX
   DO 50 I=1,3                                              PDAUX
   DER(I,N) = 0.5*WMEG(I,M)                                 PDAUX
50 VAR(I,N) = 0.0                                           PDAUX
51 CONTINUE                                                 PDAUX
99 IF  (KDINT.EQ.2)  KDINT = NQUAT                          PDAUX
   CALL ELTIME(2,6)                                         PDAUX
   RETURN                                                   PDAUX
   END                                                      PDAUX
```

```
      SUBROUTINE PLEDG(AREAL,BD,PL)                                     PLEDG
C                                                     REV IV    12/11/87HYFIX
      IMPLICIT REAL*8(A-H,O-Z)                                          PLEDG
      LOGICAL AREAL                                                     PLEDG
      DIMENSION BD(24),PL(24)                                           HYFIX
      DIMENSION HAREA(2,2,5),ZC(3,14),X(3),UV(3,2),IV(14)               HYFIX
C SHARED WITH PLELP-PLSEGF                                              HYFIX
        COMMON/TEMPVS/DMNT(3,3),DHNT(3,3),DUM1(18),TM(3),R(3),RM(3),    HYFIX
     X            DUM2(9),UP(3),VP(3),U(3),V(3),EU(3),EV(3),ET(3),      HYFIX
     X            A(2),B(2),CC(2),DUM4(12),TH(3),XH(3),RMD(3),RND(3),   HYFIX
     X            APT(2,2,2),AC(2,2),BC(2,2),AFP,E(2,2),DELT,AREA,      HYFIX
     X            AB,BB,BT(2),XNC(3),UH(3),P,AMR,FM,T4(3),ALIM(2,2)     HYFIX
     *              ,DMMY(34965)                                        80386
      EQUIVALENCE (UV(1,1),U(1))                                        HYFIX
      EQUIVALENCE (ALIM(1,1),BMIN),(ALIM(1,2),AMIN)                     HYFIX
      EQUIVALENCE (ALIM(2,1),BMAX),(ALIM(2,2),AMAX)                     HYFIX
      EQUIVALENCE (AC(1,1),BB1),(AC(1,2),AA1)                           HYFIX
      EQUIVALENCE (AC(2,1),BB2),(AC(2,2),AA2)                           HYFIX
      EQUIVALENCE (BC(1,1),AB1),(BC(1,2),BA1)                           HYFIX
      EQUIVALENCE (BC(2,1),AB2),(BC(2,2),BA2)                           HYFIX
C                                                                       HYFIX
      AREA = 0.0                                                        PLEDG
      AREAL = .FALSE.                                                   PLEDG
CALCULATE CENTER OF ELLIPSE IN PLANE                                    PLEDG
C T4 IS VECTOR FROM CENTER OF ELLIPSOID TO CENTER OF ELLIPSE            PLEDG
      DO 10 I = 1,3                                                     PLEDG
      T4(I) = FM*XH(I)                                                  HYFIX
   10 XNC(I) = XNC(I) + T4(I)                                           PLEDG
C XNC P1 TO CENTER OF ELLIPSE                                           PLEDG
C PUT PLANE VECTORS IN ELLIPSE SYSTEM   TH IS PLANE VECTOR              PLEDG
      IF (BD(1).LT.0.0) CALL MAT33(BD(8),DMNT,DHNT)                     HYPER
      IF (BD(1).LT.0.0) GO TO 20                                        HYPER
      DO 15 I = 1,3                                                     HYPER
      DO 15 J = 1,3                                                     HYPER
   15 DHNT(I,J) = DMNT(I,J)                                             HYPER
   20 CALL MAT31(DHNT,PL( 8),UP)                                        HYPER
      CALL MAT31(DHNT,PL(13),VP)                                        HYPER
      CALL MAT31(DHNT,PL(18), U)                                        HYPER
      CALL MAT31(DHNT,PL(21), V)                                        HYPER
C U IS P2 - P1, V IS P3 - P1, PLANE VECTOR IS TM                        PLEDG
CALCULATE CENTER FROM P1 IN U, V COORDINATES                            PLEDG
      B(1) = (UP(1)*XNC(1) + UP(2)*XNC(2) + UP(3)*XNC(3))/PL(12)        PLEDG
      B(2) = (VP(1)*XNC(1) + VP(2)*XNC(2) + VP(3)*XNC(3))/PL(17)        PLEDG
      AMIN = -B(1)                                                      HYFIX
      AMAX = 1.0 - B(1)                                                 HYFIX
      BMIN = -B(2)                                                      HYFIX
      BMAX = 1.0 - B(2)                                                 HYFIX
C GET ELLIPSE EQUATION                                                  PLEDG
      DO 25 I = 1,2                                                     HYPER
      DO 25 J = I,2                                                     HYPER
   25 E(I,J) = 0.0                                                      HYPER
      IF (BD(1).GT.0.0) GO TO 35                                        HYPER
```

386-ATBIV FT3

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C TREAT HYPER AS ELLIPSE FOR FIRST GUESS                                HYPER
      DO 30 I = 1,3                                                     HYPER
      EU(I) = U(I)*BD(I+16)                                             HYPER
   30 EV(I) = V(I)*BD(I+16)                                             HYPER
C GET INTERSECTION OF PLANE WITH BOX                                     HYFIX
      CALL HYBOX(BD(2),TH,T4,MB,ZC,IV)                                  HYPER
      IF (MB.LT.6) GO TO 140                                            HYPER
      GO TO 40                                                          HYPER
   35 CALL MAT31(BD(7),U,EU)                                            HYPER
      CALL MAT31(BD(7),V,EV)                                            HYPER
   40 DO 45 K = 1,3                                                     HYPER
      E(1,1) = E(1,1) + U(K)*EU(K)                                      HYPER
      E(1,2) = E(1,2) + V(K)*EU(K)                                      HYPER
   45 E(2,2) = E(2,2) + V(K)*EV(K)                                      HYPER
      DELT = E(1,1)*E(2,2) - E(1,2)**2                                  PLEDG
C WHAT ABOUT AMR FOR HYPER??   1 - FM**P ?                              HYFIX
      R2D = AMR/DELT                                                    HYFIX
COMPUTE BOUNDS OF ELLIPSOID LOCATION OF MAX AND MIN ALPHA               HYFIX
      AA2 =  DSQRT(E(2,2)*R2D)                                          HYFIX
      AA1 = -AA2                                                        HYFIX
C BA IS VALUE OF BETA AT AT ALPHA MAX                                   HYFIX
      BA1 =  E(1,2)*AA2/E(2,2)                                          HYFIX
      BA2 = -BA1                                                        HYFIX
      IF (BD(1).GE.-2.0) GO TO 50                                       HYPER
      CALL HYBND(MB,ZC,IV,UP,-1.,X)                                     HYPER
      CALL HYLIM(AA1,U,BA1,V,FM,XH,X,BD)                                HYFIX
   50 AMIN = DMAX1(AA1,AMIN)                                            HYFIX
      IF (AMIN.GE.AMAX) GO TO 140                                       HYFIX
      IF (BD(1).GE.-2.0) GO TO 55                                       HYPER
      CALL HYBND(MB,ZC,IV,UP, 1.,X)                                     HYPER
      CALL HYLIM(AA2,U,BA2,V,FM,XH,X,BD)                                HYFIX
   55 AMAX = DMIN1(AA2,AMAX)                                            HYFIX
      IF (AMIN.GE.AMAX) GO TO 140                                       HYPER
COMPUTE BOUNDS OF ELLIPSOID LOCATION OF MAX AND MIN BETA                HYFIX
      BB2 =  DSQRT(E(1,1)*R2D)                                          HYFIX
      BB1 = -BB2                                                        HYFIX
C AB IS VALUE OF ALPHA AT AT BETA MAX                                   HYFIX
      AB1 =  E(1,2)*BB2/E(1,1)                                          HYFIX
      AB2 = -AB1                                                        HYFIX
      IF (BD(1).GE.-2.0) GO TO 60                                       HYPER
      CALL HYBND(MB,ZC,IV,VP,-1.,X)                                     HYPER
      CALL HYLIM(BB1,V,AB1,U,FM,XH,X,BD)                                HYFIX
   60 BMIN = DMAX1(BB1,BMIN)                                            HYFIX
      IF (BMIN.GE.BMAX) GO TO 140                                       HYFIX
      IF (BD(1).GE.-2.0) GO TO 65                                       HYPER
      CALL HYBND(MB,ZC,IV,VP, 1.,X)                                     HYPER
      CALL HYLIM(BB2,V,AB2,U,FM,XH,X,BD)                                HYFIX
   65 BMAX = DMIN1(BB2,BMAX)                                            HYFIX
      IF (BMIN.GE.BMAX) GO TO 140                                       HYPER
COMPUTE ALPHA'S AT BMIN AND BMAX; BETA'S AT AMIN AND AMAX IF NOT ON     HYFIX
C ELLIPSOID                                                             HYFIX
      IF (BD(1).LT.-2.0) GO TO 80                                       HYPER
```

```
      DO 76 L = 1,2                                                     HYFIX
      K = 3 - L                                                         HYFIX
      DO 75 J = 1,2                                                     HYPER
      DIS = 0.0                                                         HYFIX
      AFP = BC(J,L)                                                     HYFIX
      IF (ALIM(J,L).EQ.AC(J,L)) GO TO 74                                HYFIX
      AFP = ALIM(J,L)/E(L,L)                                            HYFIX
      DISC =  AMR/E(L,L) - DELT*AFP**2                                  HYFIX
      DIS = 0.0                                                         HYFIX
      IF (DISC.GT.0.0) DIS = DSQRT(DISC)                                HYFIX
      AFP =  -AFP*E(1,2)                                                HYFIX
   74 APT(1,J,L) = DMAX1 (AFP-DIS,ALIM(1,K))                            HYFIX
      APT(2,J,L) = DMIN1 (AFP+DIS,ALIM(2,K))                            HYFIX
   75 CONTINUE                                                          HYPER
   76 CONTINUE                                                          HYFIX
      GO TO 95                                                          HYPER
   80 DO 90 L = 1,2                                                     HYPER
      K = 3 - L                                                         HYFIX
      DO 89 J = 1,2                                                     HYFIX
      DIS = 0.0                                                         HYFIX
      BT(1) = BC(J,L)                                                   HYFIX
      BT(2) = BC(J,L)                                                   HYFIX
      IF (ALIM(J,L).EQ.AC(J,L)) GO TO 88                                HYFIX
      M = 2                                                             HYFIX
      IF (ALIM(J,L).LT.0.0) M = 1                                       HYFIX
      CM = BC(M,L)/AC(M,L)                                              HYFIX
      CL = ALIM(J,L)*CM                                                 HYFIX
      DO 82 I = 1,3                                                     HYFIX
   82 RM(I) = T4(I) + ALIM(J,L)*(UV(I,K) + CM*UV(I,L))                  HYFIX
      DO 85 I = 1,2                                                     HYFIX
      CALL HYVAL(BT(I),UV(1,L),RM,BD,I)                                 HYFIX
   85 BT(I) = BT(I) + CL                                                HYFIX
   88 APT(1,J,L) = DMAX1 (BT(1),ALIM(1,K))                              HYFIX
      APT(2,J,L) = DMIN1 (BT(2),ALIM(2,K))                              HYFIX
   89 CONTINUE                                                          HYFIX
   90 CONTINUE                                                          HYPER
C  SET UP LEGAL BOUNDARIES                                              HYFIX
C  APT          L = 1                      L = 2                        HYFIX
C       A-(BMIN)   A-(BMAX)      B-(AMIN)    B-(AMAX)                   HYFIX
C       A+(BMIN)   A+(BMAX)      B+(AMIN)    B+(AMAX)                   HYFIX
C SET UP HAREA (LINE SEGMENTS) CLOCKWISE STARTING WITH AMIN             HYFIX
   95 L = 0                                                             HYFIX
      HAREA(1,1,L+1) = AMIN                                             HYFIX
      HAREA(2,1,L+1) = APT(2,1,2)                                       HYFIX
      HAREA(1,2,L+1) = AMIN                                             HYFIX
      HAREA(2,2,L+1) = APT(1,1,2)                                       HYFIX
      IF (APT(2,1,2).GE.APT(1,1,2)) L = L + 1                           HYFIX
      HAREA(1,1,L+1) = APT(1,1,1)                                       HYFIX
      HAREA(2,1,L+1) = BMIN                                             HYFIX
      HAREA(1,2,L+1) = APT(2,1,1)                                       HYFIX
      HAREA(2,2,L+1) = BMIN                                             HYFIX
      IF (APT(2,1,1).GE.APT(1,1,1)) L = L + 1                           HYFIX
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```
      HAREA(1,1,L+1) = AMAX                                             HYFIX
      HAREA(2,1,L+1) = APT(1,2,2)                                       HYFIX
      HAREA(1,2,L+1) = AMAX                                             HYFIX
      HAREA(2,2,L+1) = APT(2,2,2)                                       HYFIX
      IF (APT(2,2,2).GE.APT(1,2,2)) L = L + 1                           HYFIX
      HAREA(1,1,L+1) = APT(2,2,1)                                       HYFIX
      HAREA(2,1,L+1) = BMAX                                             HYFIX
      HAREA(1,2,L+1) = APT(1,2,1)                                       HYFIX
      HAREA(2,2,L+1) = BMAX                                             HYFIX
      IF (APT(2,2,1).GE.APT(1,2,1)) L = L + 1                           HYFIX
      IF (L.LE.1) GO TO 140                                             HYFIX
      HAREA(1,1,L+1) = HAREA(1,1,1)                                     HYFIX
      HAREA(2,1,L+1) = HAREA(2,1,1)                                     HYFIX
      IF (BD(1).GE.-2) CALL PLREA(L,HAREA,AREA,AB,BB,E,DELT,AMR)        HYFIX
      IF (BD(1).LT.-2) CALL HYREA(L,HAREA,AREA,AB,BB)                   HYFIX
      AREAL = AREA.GT.0.0                                               HYFIX
      IF (.NOT.AREAL) GO TO 140                                         HYPER
C                                                                       HYPER
      DO 120 I = 1,3                                                    HYPER
      RM(I) = AB*U(I) + BB*V(I) + T4(I)                                 HYPER
  120 RMD(I) = RM(I)                                                    HYPER
COMPUTE POINT ON ELLIPSOID BELOW CENTROID       (CONTACT POINT?)        PLEDG
CONVERT PLANE VECTOR, ET = E*TM                                         PLEDG
C TRY TO USE OTHER LOGIC                                               HYFIX
      IF(BD(1).LT.0.0)GO TO 130                                         HYPER
      CALL MAT31(BD(7),TM,ET)                                           PLEDG
      A2 = TM(1)*ET(1) + TM(2)*ET(2) + TM(3)*ET(3)                      PLEDG
      A1 = AB*(TM(1)*EU(1)+TM(2)*EU(2)+TM(3)*EU(3))                     HYFIX
     1+FM+ BB*(TM(1)*EV(1)+TM(2)*EV(2)+TM(3)*EV(3))                     HYFIX
      A1 = A1/A2                                                        HYFIX
      A0 = (AB**2*E(1,1) + 2.*AB*BB*E(1,2) + BB**2*E(2,2) - AMR)/A2     HYFIX
      DISC = A1**2 - A0                                                 PLEDG
      IF(DISC.LT.0.0)DISC = 0.0                                         PLEDG
      P = A1 + DSQRT(DISC)                                              PLEDG
      GO TO 140                                                         HYPER
COMPUTE FOR HYPER                                                       HYPER
  130 CALL HYVAL(CA,TH,RM,BD,1)                                         HYFIX
      P = -CA                                                           HYFIX
      CALL DOT31(BD(8),RMD,RM)                                          HYPER
  140 RETURN                                                            HYPER
      END                                                               PLEDG
```

```
      SUBROUTINE PLELP(M,MM,N,NN,NT)                                    PLELP
C                                                  REV IV    02/07/87HYPER
      IMPLICIT REAL*8(A-H,O-Z)                                          PLELP
      LOGICAL AREAL                                                     EDGE
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)PLELP
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),PLELP
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       PLELP
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         PLELP
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   PLELP
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),PLELP
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              PLELP
     *               KQ1(12),KQ2(12),KQTYPE(12)                         PLELP
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 TGMOD7
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TGMOD7
      COMMON/TEMPVS/DMNT(3,3),TEMP(3,3),B(3,3),XMN(3),RLN(3),XMM(3),    PLELP
     *            TM(3),R(3),RM(3),DMNWN(3),RLM(3),RN(3),VMN(3),VR(3),  PLELP
     *            WNM(3),WCM(3),WCN(3),VREL(3),FFM(3),FR(3),TQM(3),     PLELP
     *            TQN(3),TQNT(3),T(3),H(3),TH(3),XH(3),RMD(3),RND(3),   EDGE
     *            TD(3),TT4(3,4),TT5(3,4),XNC(3),UH(3),P,AMR,FM,CF,     EDGE
     *            VRM,VRT,VRTS,VRTEST,TF,ELOSS,MCF,NCF,DMMY(34964)      80386
      CALL ELTIME(1,21)                                                 PLELP
      CALL DOTT33(D(1,1,M),D(1,1,N),DMNT)                               PLELP
      DO 10 I = 1,3                                                     PLELP
   10 XMN(I) = SEGLP(I,M) - SEGLP(I,N)                                  PLELP
      CALL MAT31(D(1,1,M),XMN,XMM)                                      PLELP
      CALL MAT31(DMNT,PL(1,NN),TM)                                      PLELP
      CALL MAT31(DMNT,PL(5,NN),TD)                                      EDGE
      BET = 0.0                                                         EDGE
      J = 3                                                             HYPER
      IF(BD(1,MM).LT.0.0) J = 4                                         HYPER
      DO 15 I=1,3                                                       EDGE
      J = J + 1                                                         HYPER
      XNC(I) = XMM(I) + BD(J,MM) - TD(I)                                HYPER
   15 BET = BET - TM(I)*XNC(I)                                          EDGE
C                                                                       EDGE
C     BET IS FROM CENTER OF FIGURE TO PLANE                             EDGE
      IF(BD(1,MM).GT.0.0)GO TO 30                                       HYPER
C PUT PLANE VECTOR INTO HYPER                                           HYPER
      CALL MAT31(BD(8,MM),TM,TH)                                        HYPER
      CALL MAT31(BD(8,MM),XNC,UH)                                       HYPER
      DO 20 I = 1,3                                                     HYPER
      XNC(I) = UH(I)                                                    HYPER
      UH(I) = DABS(TH(I))*BD(I+1,MM)/BD(I+19,MM)                        HYPER
      R(I)  = BD(I+19,MM)/(BD(I+19,MM) - 1.0)                           HYPER
   20 RND(I)= UH(I)**R(I)                                               HYPER
      ALP = HYPEN(BD(1,MM),R,RND)                                       HYPER
      DO 25 I = 1,3                                                     HYPER
      POW = 1.0/(BD(I+19,MM) - 1.0)                                     HYPER
      XH(I) = -DSIGN(BD(I+1,MM)*(UH(I)*ALP)**POW,TH(I))                 HYPER
   25 RND(I) = XH(I)                                                    HYPER
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      BTE = TH(1)*XH(1) + TH(2)*XH(2) + TH(3)*XH(3)                     HYPER
      FM = BET/BTE                                                      HYPER
      AMR = 1.0 - DABS(FM)**(-BD(1,MM))                                 HYPER
      GO TO 35                                                          HYPER
C     CODE FOR ELLIPSE        XH = E'T                                  EDGE
C                                                                       EDGE
   30 CALL MAT31(BD(16,MM),TM,XH)                                       HYPER
      BTS = TM(1)*XH(1) + TM(2)*XH(2) + TM(3)*XH(3)                     EDGE
      BTE = - DSQRT(BTS)                                                PLELP
      FM = BET/BTS                                                      EDGE
      AMR = 1.0 -BET*FM                                                 EDGE
C                                                                       EDGE
   35 P = BET - BTE                                                     HYPER
      PSF(1,NPSF) = P                                                   PLELP
      MCF = NTAB(NT+1)                                                  PLELP
      NCF = -MCF                                                        PLELP
      IF(NCF.GT.0)CFQQ(NCF) = -999.                                     PLELP
      IF(P.LE.0.0) GO TO 85                                             HYPER
C                                                                       EDGE
C     CALL EDGE ROUTINE TO FIND IF ELLIPSOID INTERSECTS FINITE PLANE    EDGE
C     IF IT DOES; AREAL WILL BE TRUE, P WILL BE PENETRATION AT CENTROID EDGE
C     AND RM WILL BE LOCATION OF CENTROID                               EDGE
C     RM IS REFERENCED TO CENTER OF ELLIPSOID                           EDGE
C     USE OLD FORMULA FOR ROLL-SLIDE?, I.E. ROLL-SLIDE SHOULDN'T        EDGE
C     CALL PLEDG                                                        EDGE
C                                                                       EDGE
      LT = NTAB(NT)                                                     EDGE
      IF(TAB(LT+22).LE.0.0)GO TO 40                                     HYPER
C                                                                       EDGE
      IF (AMR.LE.0.0) GO TO 85                                          HYPER
      IF (BD(1,MM).LT.0.0.AND.BD(23,MM).NE.0.0) STOP 22                 HYPER
      CALL PLEDG(AREAL,BD(1,MM),PL(1,NN))                               EDGE
      IF(.NOT.AREAL)GO TO 85                                            HYPER
      PSF(1,NPSF) = P                                                   EDGE
C                                                                       EDGE
   40 IF (TAB(LT+22).GT.-2.0.AND.AMR.LE.0.0) GO TO 85                   HYPER
      RHO = 0.0                                                         HYPER
      IF(MCF.GT.0)RHO = TAB(MCF+4)                                      PLELP
      BETE =  1.0 + RHO*P/BTE                                           HYPER
      IF(BD(1,MM).GT.0.0)BETE = BETE/BTE                                HYPER
      IF(BD(1,MM).LT.0.0)CALL DOT31(BD(8,MM),RND,XH)                    HYPER
      TRT = P*(1.0 - RHO)                                               EDGE
      J = 3                                                             HYPER
      IF(BD(1,MM).LT.0.0)J = 4                                          HYPER
      DO 45 I = 1,3                                                     HYPER
      J = J + 1                                                         HYPER
      IF(TAB(LT+22).LE.0.0)RM(I) = BETE*XH(I)                           EDGE
      IF(TAB(LT+22).GT.0.0)RM(I) = RM(I) - TRT*TM(I)                    EDGE
      RLM(I) = RM(I) + BD(J,MM)                                         HYPER
   45 RN(I) = RLM(I) + XMM(I)                                           HYPER
      CALL DOT31(DMNT,RN,RLN)                                           PLELP
      IF (TAB(LT+22).GT.0.0) GO TO 55                                   HYPER
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      IF (TAB(LT+22).GT.-3.0.AND.TAB(LT+22).LT.0.0) GO TO 55           HYPER
C                                                                       EDGE
C     CHECK BOUNDARY USING OLD METHOD                                   EDGE
      DO 50 I = 8,13,5                                                  HYPER
      IF(PL(I+4,NN).LE.0.0)GO TO 50                                     HYPER
      DIST = RLN(1)*PL(I  ,NN)                                          PLELP
     *     + RLN(2)*PL(I+1,NN)                                          PLELP
     *     + RLN(3)*PL(I+2,NN) - PL(I+3,NN)                             PLELP
      IF((DIST.LE.0.0).OR.(DIST.GT.PL(I+4,NN))) GO TO 85                HYPER
   50 CONTINUE                                                          HYPER
C                                                                       EDGE
   55 CALL PLSEGF(M,N,NT)                                               HYPER
C     DMNWN,VMN,VR,WNM,WCM,WCN,VREL,FFM,FR,TQM,TQN,TQNT,T               EDGE
C     FM,CF,VRM,VRT,VRTS,VRTEST,TF,ELOSS                                EDGE
C                                                                       EDGE
C     STORE RESULTS                                                     EDGE
      DO 60 I = 1,3                                                     HYPER
   60 PSF(I+4,NPSF) = RLN(I)                                            HYPER
      IF(LPMI(N).NE.0) CALL DOT31(DPMI(1,1,N),RLN,PSF(5,NPSF))          EDGE
      IF(MCF.LT.0)GO TO 65                                              HYPER
      PSF(2,NPSF) = FM                                                  PLELP
      PSF(3,NPSF) = 0.0                                                 PLELP
      TRT = TF**2 - FM**2                                               PLELP
      IF(TRT.GT.0.0) PSF(3,NPSF) = DSQRT(TRT)                           PLELP
      PSF(4,NPSF) = TF                                                  PLELP
      GO TO 85                                                          HYPER
C                                                                       PLELP
C      ROLL-SLIDE             REVISED         8/18/85                   PLELP
   65 DO 70 I = 1,3                                                     HYPER
   70 PSF(I+1,NPSF) = T(I)                                              HYPER
      IF(BD(1,MM).LT.0.0) STOP 28                                       HYPER
      CALL CROSS(TM,WNM,TH)                                             EDGE
      CALL MAT31(BD(16,MM),TH,UH)                                       EDGE
      TRT = (TM(1)*UH(1) + TM(2)*UH(2) + TM(3)*UH(3))/BTS               EDGE
      DO 75 I = 1,3                                                     HYPER
   75 RMD(I) = DABS(BETE)*(UH(I) - TRT*XH(I))                           HYPER
      CALL CROSS(DMNWN,TM,TH)                                           EDGE
      CALL CROSS(WNM,RMD,XNC)                                           EDGE
      SQQ(NCF) = 0.0                                                    PLELP
      DO 80 I = 1,3                                                     HYPER
   80 SQQ(NCF) = SQQ(NCF) + TM(I)*XNC(I) - 2.0*TH(I)*VR(I)              HYPER
      CALL DOT31(D(1,1,M),XNC,RQQ(1,NCF))                               EDGE
   85 CALL ELTIME(2,21)                                                 HYPER
      RETURN                                                            PLELP
      END                                                               PLELP
```

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      SUBROUTINE PLREA(L,H,AREA,AB,BB,E,D,R)                          HYFIX
C                                                        REV IV 12/11/87HYFIX
      IMPLICIT REAL*8(A-H,O-Z)                                        PLREA
COMPUTES AREA AND CENTROID (TRUE AREA = AREA*|UxV|/6)                 HYFIX
C |UxV| IS NEVER COMPUTED    |UxV| = UxV.T = AREA OF PARALLELOGRAM    PLREA
C THIS ROUTINE WILL ONLY BE CALLED IF THERE IS AN INTERSECTION        PLREA
      DIMENSION H(2,2,5),E(2,2)                                       HYFIX
      AREA = 0.0                                                      PLREA
      AB = 0.0                                                        PLREA
      BB = 0.0                                                        PLREA
      IF (L.LE.1) GO TO 15                                            HYFIX
      C = R/DSQRT(D)                                                  HYFIX
      C12 = 2.0*R/D                                                   HYFIX
      C11 = C12*E(1,1)                                                HYFIX
      C22 = C12*E(2,2)                                                HYFIX
      C12 = C12*E(1,2)                                                HYFIX
      DO 10 I = 1,L                                                   HYFIX
COMPUTE FOR STRAIGHT LINE SEGMENTS                                    HYFIX
      AR = H(1,1,I)*H(2,2,I) - H(1,2,I)*H(2,1,I)                      HYFIX
      IF (AR.EQ.0.0) GO TO 5                                          HYFIX
      AB = AB + AR*(H(1,1,I) + H(1,2,I))                              HYFIX
      BB = BB + AR*(H(2,1,I) + H(2,2,I))                              HYFIX
      AREA = AREA + AR                                                HYFIX
COMPUTE FOR ELLIPSE                                                   HYFIX
    5 AR = H(1,2,I)*H(2,1,I+1) - H(1,1,I+1)*H(2,2,I)                  HYFIX
      IF (AR.EQ.0.0) GO TO 10                                         HYFIX
      ARC = AR/C                                                      HYFIX
      IF (DABS(ARC).GT.1.0) ARC = DSIGN(1.0D0,ARC)                    HYFIX
      AR = C*DASIN(ARC)                                               HYFIX
      X21 = H(1,1,I+1) - H(1,2,I)                                     HYFIX
      Y21 = H(2,1,I+1) - H(2,2,I)                                     HYFIX
      AB = AB + C12*X21 + C22*Y21                                     HYFIX
      BB = BB - C11*X21 - C12*Y21                                     HYFIX
      AREA = AREA + AR                                                HYFIX
   10 CONTINUE                                                        HYFIX
      IF (AREA.LE.0.0) GO TO 15                                       HYFIX
      AREA = 3.0*AREA                                                 HYFIX
      AB = AB/AREA                                                    PLREA
      BB = BB/AREA                                                    PLREA
C     AREA = AREA/6.0                                                 HYFIX
   15 RETURN                                                          PLREA
      END                                                             PLREA
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      SUBROUTINE PLSEGF(M,N,NT)                                         PLSEGF
C                                                 REV III.5 09/03/85TGMOD7
      IMPLICIT REAL*8 (A-H,O-Z)                                         PLSEGF
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),PLSEGF
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       PLSEGF
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   PLSEGF
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),PLSEGF
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              PLSEGF
     *               KQ1(12),KQ2(12),KQTYPE(12)                         PLSEGF
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           PLSEGF
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
C     THIS COMMON/TEMPVS/ IS SHARED BY PLELP, PLSEGF AND SEGSEG.        PLSEGF
      COMMON/TEMPVS/DMNT(3,3),TEMP(3,3),B(3,3),XMN(3),RLN(3),XMM(3),    PLSEGF
     *              TM(3),R(3),RM(3),DMNWN(3),RLM(3),RN(3),VMN(3),VR(3),PLSEGF
     *              WMN(3),WCM(3),WCN(3),VREL(3),FFM(3),FR(3),TQM(3),   PLSEGF
     *              TQN(3),TQNT(3),T(3),H(3),T1(3),T2(3),RMD(3),RND(3), PLSEGF
     *              TD(3),TT4(3,4),TT5(3,4),T3(3),T4(3),P,AMR,FM,CF,    PLSEGF
     *              VRM,VRT,VRTS,VRTEST,TF,ELOSS,MCF,NCF,T5(3),T6(3)    TGMOD7
     *              ,DMMY(34958)                                        80386
      VRTEST = 2.0                                                      PLSEGF
      CALL MAT31(DMNT,WMEG(1,N),DMNWN)                                  PLSEGF
      DO 15 I=1,3                                                       PLSEGF
      VMN(I) = SEGLV(I,M) - SEGLV(I,N)                                  PLSEGF
   15 WMN(I) = DMNWN(I) - WMEG(I,M)                                     PLSEGF
      CALL DOT31(D(1,1,M),TM,T)                                         PLSEGF
      CALL MAT31(D(1,1,M),VMN,VR)                                       PLSEGF
      CALL CROSS(WMEG(1,M),RLM,WCM)                                     PLSEGF
      CALL CROSS(DMNWN,RN,WCN)                                          PLSEGF
      VRM = 0.0                                                         PLSEGF
      DO 16 I=1,3                                                       PLSEGF
      VR(I) = VR(I) + WCM(I) - WCN(I)                                   PLSEGF
   16 VRM = VRM + VR(I)*TM(I)                                           PLSEGF
      VRT = 0.0                                                         PLSEGF
      DO 17 I=1,3                                                       PLSEGF
      VREL(I) = VR(I) - VRM*TM(I)                                       PLSEGF
   17 VRT = VRT + VREL(I)**2                                            PLSEGF
      VRT = DSQRT(VRT)                                                  PLSEGF
      CF = EVALFD (P,NTAB(NT+5),1)                                      PLSEGF
      LT = NTAB(NT)                                                     PLSEGF
      TAB(LT) = P                                                       PLSEGF
      FM = 1.0                                                          PLSEGF
      PDOT = -VRM                                                       PLSEGF
      ELOSS = 0.0                                                       PLSEGF
      IF (MCF.GT.0) CALL FRCDFL(P,PDOT,NT,1,FM,ELOSS)                   PLSEGF
      VRTS = VRT                                                        PLSEGF
      IF (VRT.LT.VRTEST) VRT = VRTEST/(2.0-VRT/VRTEST)                  PLSEGF
      FF = -DABS(FM)*CF/VRT                                             PLSEGF
      IF (NCF.GT.0.AND.KQTYPE(NCF).EQ 6)  FF=0.0                        PLSEGF
      FS = (VRTS-VRT)/VRT                                               PLSEGF
      IF (NCF.GT.0.AND.KQTYPE(NCF).EQ 6)  FS=0.0                        PLSEGF
      TF = 0.0                                                          PLSEGF
      L = LT+18                                                         PLSEGF
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      DO 18 I=1,3                                                        PLSEGF
      L = L+1                                                            PLSEGF
      FFM(I) = FM*TM(I) + FF*VREL(I) + FS*TAB(L)                         PLSEGF
      TF = TF + FFM(I)**2                                                PLSEGF
      TTI(I) = T(I)                                                      PLSEGF
      R1I(I) = RLM(I)                                                    PLSEGF
   18 R2I(I) = RLN(I)                                                    PLSEGF
      TF = DSQRT(TF)                                                     PLSEGF
      MT = NTAB(NT+5)                                                    PLSEGF
      CREST = TAB(MT+3)                                                  PLSEGF
      CALL DOT31 (D(1,1,M),FFM,FR)                                       PLSEGF
      IF (MCF.LE.0) GO TO 21                                             PLSEGF
      CALL CROSS (RLM,FFM,TQM)                                           PLSEGF
      CALL CROSS (RN,FFM,TQNT)                                           PLSEGF
      CALL DOT31 (DMNT,TQNT,TQN)                                         PLSEGF
      DO 19 I=1,3                                                        PLSEGF
      U1(I,M) = U1(I,M) + FR(I)                                          PLSEGF
      U1(I,N) = U1(I,N) - FR(I)                                          PLSEGF
      U2(I,M) = U2(I,M) + TQM(I)                                         PLSEGF
   19 U2(I,N) = U2(I,N) - TQN(I)                                         PLSEGF
      IF (NCF.LE.0) GO TO 23                                             PLSEGF
   21 DO 22 I=1,3                                                        PLSEGF
      HQQ(I,NCF) = FR(I)/TF                                              PLSEGF
      TQQ(I,NCF) = T(I)                                                  PLSEGF
      RK1(I,NCF) = RLM(I)                                                PLSEGF
   22 RK2(I,NCF) = RLN(I)                                                PLSEGF
      CFQQ(NCF)  = CF                                                    PLSEGF
      MT = NTAB(NT+5)                                                    PLSEGF
      IF (KQTYPE(NCF).EQ.3) CFQQ(NCF) = TAB(MT+4)                        PLSEGF
   23 RETURN                                                             PLSEGF
      END                                                                PLSEGF
```

```
      SUBROUTINE PLTXYZ(P,C)                                            PLTXYZ
C                                                  REV III.5 05/30/85VEHICL
C     STORES PLOT CHARACTER (C) INTO PLOTYZ, PLOTXZ AND PLOTXY ARRAYS   PLTXYZ
C     IN VEHICLE REFERENCE FOR POINT (P) GIVEN IN INERTIAL REFERENCE.   PLTXYZ
C                                                                       PLTXYZ
      IMPLICIT REAL*8 (A-H,O-Z)                                         PLTXYZ
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           PLTXYZ
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),PLTXYZ
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       PLTXYZ
      COMMON/VPOSTN/ ZPLT(3),SPLT(3),AXV(3,6),VATAB(6,501,6),           VEHICL
     *               VTO(6),VDT(6),TIMEV(6),OMEGV(6),NVTAB(6),INDXV(6)  PLTXYZ
      COMMON/TEMPVS/ DUM(101),PLOTYZ(96,55),PLOTXZ(96,55),PLOTXY(96,55) PLTXYZ
     *              ,DMMY(33032)                                        80386
      LOGICAL*1   C,PLOTYZ,PLOTXZ,PLOTXY                                PLTXYZ
      DIMENSION P(3),TMP(3),XYZ(3)                                      PLTXYZ
      DATA NPLTZ/96/ , NPLTX/55/                                        PLTXYZ
C                                                                       PLTXYZ
C     CONVERT P FROM INERTIAL TO VEHICLE REFERENCE BY                   PLTXYZ
C         XYZ = DVEH(P-XCOMP)                                           PLTXYZ
C                                                                       PLTXYZ
      DO 10 I=1,3                                                       PLTXYZ
   10 TMP(I) = P(I) - SEGLP(I,NVEH)                                     PLTXYZ
      CALL MAT31(D(1,1,NVEH),TMP,XYZ)                                   PLTXYZ
C                                                                       PLTXYZ
C     CONVERT XYZ INTO PLOT CORDINATES IX,IY,IZ AND                     PLTXYZ
C     IF WITHIN PLOT LIMITS, STORE C IN PLOTYZ, PLOTXZ AND PLOTXY.      PLTXYZ
C                                                                       PLTXYZ
      IX = SPLT(1)*XYZ(1) + ZPLT(1) + 0.5                               PLTXYZ
      IZ = SPLT(3)*XYZ(3) + ZPLT(3) + 0.5                               PLTXYZ
      IF (IZ.LT.1 .OR. IZ.GT.NPLTZ) GO TO 11                            PLTXYZ
      IY = SPLT(2)*XYZ(2) + ZPLT(2) + 0.5                               PLTXYZ
      IF (IY.GE.1 .AND. IY.LE.NPLTX) PLOTYZ(IZ,IY) = C                  PLTXYZ
      IF (IX.GE.1 .AND. IX.LE.NPLTX) PLOTXZ(IZ,IX) = C                  PLTXYZ
   11 IY = -SPLT(3)*XYZ(2) + ZPLT(2) + 0.5                              PLTXYZ
      IF (IY.LT.1 .OR.  IY.GT.NPLTZ) GO TO 99                           PLTXYZ
      IF (IX.GE.1 .AND. IX.LE.NPLTX) PLOTXY(IY,IX) = C                  PLTXYZ
   99 RETURN                                                            PLTXYZ
      END                                                               PLTXYZ
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```
      SUBROUTINE POSTPR(PRDT)                                           POSTPR
C                                                      REV IV    02/01/88MISDOT
C     CONTROLS GENERATION OF PRINTED TABULAR TIME HISTORIES             POSTPR
C     AND PLOTS BY THE VALUE OF NPRT(4) AS FOLLOWS:                     POSTPR
C                                                                       POSTPR
C      VALUE OF       TIME                                              POSTPR
C      NPRT(4)     HISTORIES    PLOTS                                   POSTPR
C                                                                       POSTPR
C        +4            **         NO                                    POSTPR
C        +3           YES        YES                                    POSTPR
C        +2           YES         NO                                    POSTPR
C        +1            **        YES                                    POSTPR
C         0            **         NO                                    POSTPR
C        -1            NO        YES                                    POSTPR
C        -2           YES         NO                                    POSTPR
C        -3           YES        YES                                    POSTPR
C                                                                       POSTPR
C      **  TIME HISTORIES WERE PRINTED BY SUBROUTINE OUTPUT.            POSTPR
C                                                                       POSTPR
      COMMON/CDINT/ JDTPTS(18),ZZ(1000,3),DMMY(8068)                    80386
C     NOTE: THIS OVERWRITES COMMON /CDINT/.                             POSTPR
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           POSTPR
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      REAL*8 TIME                                                       POSTPR
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         POSTPR
      REAL*8 PSF,BSF,SSF,BAGSF,PRJNT                                    POSTPR
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           POSTPR
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       POSTPR
     *               JOINT(30),CGS(30),JS(30)                           POSTPR
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      POSTPR
      LOGICAL*1 CGS,JS                                                  POSTPR
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         POSTPR
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      REAL*8 PI,RADIAN,G,THIRD,EPS,UNITL,UNITM,UNITT,GRAVTY,TWOPI       80386
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), POSTPR
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), POSTPR
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               POSTPR
      COMMON     R/ APSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)POSTPR
      REAL*8 ..  1,APSDN,ASD                                            POSTPR
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       POSTPR
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          POSTPR
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         POSTPR
      REAL*8 BAR,BB,BBDOT,PLOSS,XLONG,HTIME                             POSTPR
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      REAL*8 XSG,DPMI,TDATA,UMSEC,PRDT,TEST1,TEST2,VDT1                 TGMOD1
      REAL*8 VDT2,R30,R26                                               TGMOD1
C     NOTE: SUBROUTINES POSTPR & HEDING SHARE THIS COMMON/TEMPVS/.      POSTPR
C     THE FIRST DIMENSION OF XLAB,YLAB,PLB1 AND PLB2 SHOULD BE THE SAME POSTPR
C     AS THE VALUE ASSIGNED TO NW60 WHICH IS THE NUMBER OF WORDS THAT   POSTPR
C     IS NECESSARY TO CONTAIN 60 CONSECUTIVE CHARACTERS DEPENDING ON THEPOSTPR
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C     COMPUTER SYSTEM THIS PROGRAM IS OPERATING ON. THE VALUE OF NW60   POSTPR
C     SHOULD BE 15 ON IBM 360 AND 370, 10 ON UNIVAC 1108, 6 ON CDC 6600.POSTPR
C     THE LAST TERM IN FORMAT 13 BELOW SHOULD BE 15A4(IBM), 10A6(UNIVAC)POSTPR
C     OR 6A10(CDC). ALSO, THE FIRST DIMENSION OF PLDATA IN SUBROUTINE   POSTPR
C     HEDING SHOULD BE 97(IBM), 77(UNIVAC) OR 61(CDC).                  REDIM2
C                                                                       POSTPR
      COMMON/TEMPVS/ TDATA(14,65),HEDATA(470),                          POSTPR
     *              X0(20),XN(20),XL(20),XS(20),XLAB(15,20),PLB1(15,20),POSTPR
     *              Y0(20),YN(20),YL(20),YS(20),YLAB(15,20),PLB2(15,20),POSTPR
     *              NYP(20),MX(2,20),MY(2,10,20),NX(20),NY(20),         POSTPR
     *              NXLAB(20),NYLAB(20),NPLB1(20),NPLB2(20),            POSTPR
     *              USEC(45),Z(1000,25),ZTTH(14,45,65),IDMMY            80386
      CHARACTER*4 XLAB,YLAB,PLB1,PLB2                                   80386
      COMMON/DEVICE/ IDEF,IOPORT,MODEL                                  80386
      LOGICAL LTABH,LPLOT                                               POSTPR
      DATA  LPP/45/ , NZD1/1000/, NZD2/25/                              PLTINC
      DATA NW60/15/                                                     POSTPR
      LTABH = .FALSE.                                                   POSTPR
      LPLOT = .FALSE.                                                   POSTPR
      NPRT4 = IABS(NPRT(4))                                             POSTPR
      LPLOT = NPRT4.EQ.1 .OR. NPRT4.EQ.3                                POSTPR
      LTABH = NPRT4.EQ.2 .OR. NPRT4.EQ.3                                POSTPR
      IF(NPRT(26).EQ.4) LTABH = .FALSE.                                 TGMOD1
      IF(NPRT(26).GE.5) GO TO 99                                        TGMOD1
C                                                                       POSTPR
C     READ INPUT CARD H.11 TO CONTROL COMPUTATION OF HIC, HSI & CSI.    WINDOP
C                                                                       POSTPR
      READ  (5,11)  JDTPTS                                              POSTPR
      WRITE(6,700) NPG                                                  PAGE
      NPG=NPG+1                                                         PAGE
  700 FORMAT(1H1,122X,'PAGE',I5/,2X,                                    PAGE
     *       'POSTPROCESSOR CONTROL PARAMETERS',/)                      PAGE
      WRITE(6,701)                                                      CHGIII
  701 FORMAT(13X,'HIC & HSI POINT',7X,'CSI POINT')                      CHGIII
      WRITE(6,702) JDTPTS(1),JDTPTS(2)                                  CHGIII
  702 FORMAT(5X,'H.11',10X,I2,17X,I2,//)                                WINDOP
      NDPT = 0                                                          POSTPR
      IHIC = 0                                                          TGMOD1
      I26 = 0                                                           TGMOD1
      ITST1 = 0                                                         TGMOD1
      ITST2 = 0                                                         TGMOD1
      IF(NPRT(26).LT.0) I26 = IABS(NPRT(26))                            TGMOD1
      IF(JDTPTS(1).GT.0.OR.JDTPTS(2).GT.0) IHIC = 1                     TGMOD1
      IF(NPRT(30).EQ.0.AND.NPRT(26).EQ.3) ITST1 = 1                     TGMOD1
      IF(NPRT(30).LT.I26) ITST2 = 1                                     TGMOD1
      IF(IHIC.EQ.1.AND.ITST1.EQ.1) WRITE(6,751)                         TGMOD1
      IF(IHIC.EQ.1.AND.ITST2.EQ.1) WRITE(6,752) NPRT(30),I26            TGMOD1
  751 FORMAT(3X,'WARNING!  LOGIC OF INPUT INDICATES USER ANTICIPATES HICTGMOD1
     *, HSI AND CSI TO BE COMPUTED BASED ON DATA FOR EVERY SUCCESSFUL', TGMOD1
     */,10X,'INTEGRATION STEP, YET DATA WAS STORED (WRITTEN TO TAPE8) EVTGMOD1
     *ERY DT.')                                                         TGMOD1
  752 FORMAT(3X,'WARNING!  LOGIC OF INPUT INDICATES USER ANTICIPATES HICTGMOD1
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     *, HSI AND CSI TO BE COMPUTED BASED ON DATA FOR EVERY ',I2,/,10X,' TGMOD1
     *INTEGER MULTIPLE OF DT, YET DATA WAS STORED (WRITTEN TO TAPE8) EVETGMOD1
     *RY ',I2,' INTEGER MULTIPLE OF DT.')                              TGMOD1
      IF(JDTPTS(1).GT.0.AND.NPRT(26).EQ.2.AND.NPRT(30).LT.1) STOP 91   TGMOD1
      IF(JDTPTS(2).GT.0.AND.NPRT(26).EQ.2.AND.NPRT(30).LT.1) STOP 92   TGMOD1
      IF  (JDTPTS(1).NE.0)  NDPT = NDPT + 1                            POSTPR
      IF  (JDTPTS(2).NE.0)  NDPT = NDPT + 1                            POSTPR
      IF  (.NOT.LPLOT .AND. .NOT.LTABH .AND. NDPT.EQ.0) GO TO 99       POSTPR
      CALL ELTIME (1,36)                                               POSTPR
      IF  (.NOT.LPLOT)  GO TO 20                                       POSTPR
C                                                                      POSTPR
C     READ INDICES OF VARIABLES TO BE PLOTTED AND                      POSTPR
C     ARGUMENTS TO SUBROUTINE SLPLOT ON CARDS I.                       POSTPR
C                                                                      POSTPR
C         INPUT CARD I.1                                               POSTPR
C                                                                      POSTPR
      READ  (5,11)  NPLT , (NYP(K),K=1,NPLT)                           POSTPR
   11 FORMAT (18I4)                                                    POSTPR
      IF(NPLT.GT.0.AND.ITST1.EQ.1) WRITE(6,753)                        TGMOD1
      IF(NPLT.GT.0.AND.ITST2.EQ.1) WRITE(6,754) NPRT(30),I26           TGMOD1
  753 FORMAT(3X,'WARNING!  LOGIC OF INPUT INDICATES USER ANTICIPATES PLOTGMOD1
     *TS TO BE COMPUTED BASED ON DATA FOR EVERY SUCCESSFUL INTEGRATION STGMOD1
     *TEP',/,10X,'YET DATA WAS STORED (WRITTEN TO TAPE8) EVERY DT.')   TGMOD1
  754 FORMAT(3X,'WARNING!  LOGIC OF INPUT INDICATES USER ANTICIPATES PLOTGMOD1
     *TS TO BE COMPUTED BASED ON DATA FOR EVERY ',I2,/,10X,'INTEGER MULTTGMOD1
     *PLE OF DT, YET DATA WAS STORED (WRITTEN TO TAPE8) EVERY ',I2,    TGMOD1
     *    ' INTEGER MULTIPLE OF DT.')                                  TGMOD1
      IF  (NPLT.LE.0)  LPLOT = .FALSE.                                 POSTPR
      IF  (.NOT.LPLOT)  GO TO 20                                       POSTPR
      DO  15  K=1,NPLT                                                 POSTPR
      NYPLT = NYP(K)                                                   POSTPR
C                                                                      POSTPR
C         INPUT CARD I.2.K                                             POSTPR
C                                                                      POSTPR
      READ  (5,11)  MX(1,K), MX(2,K), (MY(1,J,K), MY(2,J,K), J=1,NYPLT) POSTPR
C                                                                      POSTPR
C         INPUT CARD I.3.K                                             POSTPR
C                                                                      POSTPR
      READ  (5,12)  NX(K), X0(K), XN(K), XL(K), XS(K)                  POSTPR
   12 FORMAT (I4 , 4X , 4F8.0 )                                        POSTPR
C                                                                      POSTPR
C         INPUT CARD I.4.K                                             POSTPR
C                                                                      POSTPR
      READ  (5,12)  NY(K), Y0(K), YN(K), YL(K), YS(K)                  POSTPR
C                                                                      POSTPR
C         INPUT CARD I.5.K                                             POSTPR
C                                                                      POSTPR
      READ  (5,13)  NXLAB(K), (XLAB(I,K),I=1,NW60)                     POSTPR
   13 FORMAT (I4 , 4X , 15A4)                                          POSTPR
C                                                                      POSTPR
C     NOTE - ABOVE FORMAT ASSUMES 4 ALPHANUMERIC CHARACTERS FOR SINGLE POSTPR
C     PRECISION WORDS ON IBM 360 AND 370 COMPUTERS  THE 15A4 TERM IN THEPOSTPR
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C     FORMAT WILL HAVE TO BE CHANGED ON NON-IBM COMPUTERS TO PRODUCE A  POSTPR
C     CONTINUOUS STRING OF 60 CHARACTERS IN CORE MEMORY.                 POSTPR
C                                                                         POSTPR
C         INPUT CARD I.6.K                                                POSTPR
C                                                                         POSTPR
      READ  (5,13)  NYLAB(K), (YLAB(I,K),I=1,NW60)                        POSTPR
C                                                                         POSTPR
C         INPUT CARD I.7.K                                                POSTPR
C                                                                         POSTPR
      READ  (5,13)  NPLB1(K), (PLB1(I,K),I=1,NW60)                        POSTPR
C                                                                         POSTPR
C         INPUT CARD I.8.K                                                POSTPR
C                                                                         POSTPR
   15 READ  (5,13)  NPLB2(K), (PLB2(I,K),I=1,NW60)                        POSTPR
C                                                                         CHGIII
C     WRITE OUT PLOTTING CONTROL DATA                                     CHGIII
C                                                                         CHGIII
      WRITE(6,703)                                                        CHGIII
  703 FORMAT(4X,'PLOTTING CONTROLS',/)                                    CHGIII
      WRITE(6,704)                                                        CHGIII
  704 FORMAT(12X,'NO. PLOTS',11X,'NO. OF Y VARIABLES PER PLOT')           CHGIII
      WRITE(6,705) NPLT,(NYP(JK),JK=1,NPLT)                               CHGIII
  705 FORMAT(5X,'I.1',7X,I2,7X,20(I2,2X))                                 CHGIII
      WRITE(6,706)                                                        CHGIII
  706 FORMAT(12X,'MX1 MX2 MY1A MY2A MY1B MY2B MY1C MY2C MY1D MY2D MY1E MCHGIII
     *Y2E MY1F MY2F MY1G MY2G MY1H MY2H MY1I MY2I MY1J MY2J')             CHGIII
      DO 730 IJ=1,NPLT                                                    CHGIII
      WRITE(6,707) IJ,MX(1,IJ),MX(2,IJ),                                  CHGIII
     * (MY(1,L,IJ),MY(2,L,IJ),L=1,NYP(IJ))                                CHGIII
  707 FORMAT(5X,'I.2.',I2,2X,I2,2X,I2,2X,20(I2,3X))                       CHGIII
  730 CONTINUE                                                            CHGIII
      WRITE(6,708)                                                        CHGIII
  708 FORMAT(14X,'NX',8X,'X0',9X,'XN',8X,'XL',9X,'XS')                    CHGIII
      DO 731 IJ=1,NPLT                                                    CHGIII
      WRITE(6,709) IJ,NX(IJ),X0(IJ),XN(IJ),XL(IJ),XS(IJ)                  CHGIII
  709 FORMAT(5X,'I.3.',I2,2X,I3,4X,4(F8.3,2X))                            CHGIII
  731 CONTINUE                                                            CHGIII
      WRITE(6,710)                                                        CHGIII
  710 FORMAT(14X,'NY',8X,'Y0',9X,'YN',8X,'YL',9X,'YS')                    CHGIII
      DO 732 IJ=1,NPLT                                                    CHGIII
      WRITE(6,711) IJ,NY(IJ),Y0(IJ),YN(IJ),YL(IJ),YS(IJ)                  CHGIII
  711 FORMAT(5X,'I.4.',I2,2X,I3,4X,4(F8.3,2X))                            CHGIII
  732 CONTINUE                                                            CHGIII
      WRITE(6,712)                                                        CHGIII
  712 FORMAT(12X,'NXLAB',15X,'XLAB')                                      CHGIII
      DO 733 IJ=1,NPLT                                                    CHGIII
      WRITE(6,713) IJ,NXLAB(IJ),(XLAB(L,IJ),L=1,NW60)                     CHGIII
  713 FORMAT(5X,'I.5.',I2,2X,I3,5X,15A4)                                  CHGIII
  733 CONTINUE                                                            CHGIII
      WRITE(6,714)                                                        CHGIII
  714 FORMAT(12X,'NYLAB',15X,'YLAB')                                      CHGIII
      DO 734 IJ=1,NPLT                                                    CHGIII
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```
      WRITE(6,715) IJ,NYLAB(IJ),(YLAB(L,IJ),L=1,NW60)                  CHGIII
  715 FORMAT(5X,'I.6.',I2,2X,I3,5X,15A4)                               CHGIII
  734 CONTINUE                                                         CHGIII
      WRITE(6,716)                                                     CHGIII
  716 FORMAT(12X,'NPLB1',15X,'PLB1')                                   CHGIII
      DO 735 IJ=1,NPLT                                                 CHGIII
      WRITE(6,717) IJ,NPLB1(IJ),(PLB1(L,IJ),L=1,NW60)                  CHGIII
  717 FORMAT(5X,'I.7.',I2,2X,I3,5X,15A4)                               CHGIII
  735 CONTINUE                                                         CHGIII
      WRITE(6,718)                                                     CHGIII
  718 FORMAT(12X,'NPLB2',15X,'PLB2')                                   CHGIII
      DO 736 IJ=1,NPLT                                                 CHGIII
      WRITE(6,719) IJ,NPLB2(IJ),(PLB2(L,IJ),L=1,NW60)                  CHGIII
  719 FORMAT(5X,'I.8.',I2,2X,I3,5X,15A4)                               CHGIII
  736 CONTINUE                                                         CHGIII
C                                                                      POSTPR
C     READ TIME HISTORY DATA FROM TAPE 8.                              POSTPR
C                                                                      POSTPR
  20  NPTS = 0                                                         POSTPR
      LINES = 0                                                        POSTPR
      IF  (NPRT(4).GT.0)  REWIND 8                                     POSTPR
      READ  (8,END=29)  NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,NPANEL,     POSTPR
     *                  MNPL,MNBLT,MNSEG,MNBAG,MPL,MBLT,MSEG,MBAG      POSTPR
      READ  (8,END=29)  DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL, POSTPR
     *                  SEG,JOINT,UNITL,UNITM,UNITT,NSG,MSG,XSG,MCG,   ATBIII
     *                  MCGIN,KREF,NHRNSS,NBLTPH,NPTSPB,NSD,MSDM,MSDN  CHGIII
   21 READ  (8,END=29)  NT, UMSEC, ((TDATA(I,J),I=1,14),J=1,NT)        POSTPR
      R30 = 1.0D0                                                      TGMOD1
      IF(NPRT(30).GT.0) R30 = NPRT(30)                                 TGMOD1
      VDT1 = R30*PRDT                                                  TGMOD1
      TEST1 = DMOD(UMSEC,VDT1)                                         TGMOD1
      TEST1 = DMIN1(TEST1,DABS(VDT1 -TEST1))                           TGMOD1
      IF(NPRT(30).GT.0.AND.TEST1.GT.EPS(4)) GO TO 25                   TGMOD1
      NPTS = NPTS + 1                                                  POSTPR
      IF (NPTS.GT.NZD1 .AND. (NDPT.NE.0 .OR. LPLOT) ) STOP 52          ATBIII
      ZZ(NPTS,1) = UMSEC                                               PLTINC
      Z(NPTS,1) = UMSEC                                                PLTINC
      IF  (NDPT.EQ.0)  GO TO 22                                        POSTPR
C                                                                      POSTPR
C     STORE DATA FOR HIC, HSI AND CSI.                                 POSTPR
C                                                                      POSTPR
      JJ = 1                                                           POSTPR
      DO  61  I=1,2                                                    POSTPR
      IF  (JDTPTS(I).EQ.0)  GO TO 61                                   POSTPR
      JJ = JJ +1                                                       POSTPR
      JD = JDTPTS(I) - 1                                               POSTPR
      JE = 4*MOD(JD,3) + 4                                             POSTPR
      JP = JD/3 + 1                                                    POSTPR
      ZZ(NPTS,JJ) = TDATA(JE,JP)                                       PLTINC
   61 CONTINUE                                                         POSTPR
   22 IF  (.NOT.LPLOT)  GO TO 25                                       POSTPR
C                                                                      POSTPR
```

```
C     STORE DATA FOR PLOTTING                                           POSTPR
C                                                                       POSTPR
      JY =  1                                                           PLTINC
      DO  24  K=1,NPLT                                                  POSTPR
      JE = IABS(MX(2,K))                                                POSTPR
      IF  (JE.EQ.0)  GO TO 23                                           POSTPR
      JY = JY + 1                                                       POSTPR
      IF (JY.GT.NZD2) STOP 53                                           ATBIII
      JP = MX(1,K) - 20                                                 POSTPR
      Z(NPTS,JY) = TDATA(JE,JP)                                         POSTPR
   23 NYPLT = NYP(K)                                                    POSTPR
      DO  24  J=1,NYPLT                                                 POSTPR
      JY = JY + 1                                                       POSTPR
      JP = MY(1,J,K) - 20                                               POSTPR
      IF (JY.GT.NZD2) STOP 54                                           ATBIII
      JE = IABS(MY(2,J,K))                                              POSTPR
      Z(NPTS,JY) = UMSEC                                                POSTPR
   24 IF  (JE.NE.0)  Z(NPTS,JY) = TDATA(JE,JP)                          POSTPR
   25 IF  (.NOT.LTABH)  GO TO 21                                        POSTPR
C                                                                       POSTPR
C     STORE DATA TO PRINT TABULAR TIME HISTORIES                        POSTPR
C                                                                       POSTPR
      R26 = 1.0D0                                                       TGMOD1
      IF(NPRT(26).LT.0) IFLG = 1                                        TGMOD1
      IF(IFLG.EQ.1) N26 = IABS(NPRT(26))                                TGMOD1
      IF(IFLG.EQ.1) R26 = N26                                           TGMOD1
      VDT2 = R26*PRDT                                                   TGMOD1
      TEST2 = DMOD(UMSEC,VDT2)                                          TGMOD1
      TEST2 = DMIN1(TEST2,DABS(VDT2 - TEST2))                           TGMOD1
      IF  (NPRT(26).LE.0 .AND. TEST2.GT.EPS(4))  GO TO 21               TGMOD1
      LINES = LINES + 1                                                 POSTPR
      NTTH = MOD(LINES-1,LPP) + 1                                       POSTPR
      USEC(NTTH) = UMSEC                                                POSTPR
      DO  26  J=1,NT                                                    POSTPR
      DO  26  I=1,14                                                    POSTPR
   26 ZTTH(I,NTTH,J) = TDATA(I,J)                                       POSTPR
      IF  (NTTH.EQ.LPP)  CALL HEDING (LINES,LPP)                        POSTPR
      GO TO 21                                                          POSTPR
   29 IF  (.NOT.LTABH .OR. LINES.EQ.0)  GO TO 30                        POSTPR
      IF  (NTTH.NE.LPP)  CALL HEDING (LINES,LPP)                        POSTPR
   30 IF  (NDPT.NE.0)  CALL HICCSI(NPTS)                                POSTPR
      IF  (.NOT.LPLOT)  GO TO 98                                        POSTPR
C                                                                       POSTPR
C     PLOT DATA VIA SUBROUTINE SLPLOT.                                  POSTPR
C                                                                       POSTPR
C     INCLUDE ANY PROGRAM STATEMENTS HERE REQUIRED BY YOUR COMPUTER AND POSTPR
C     PLOTTING SYSTEMS FOR PLOT INITIALIZATION (E.G., CALL PLOTS).      POSTPR
C                                                                       POSTPR
      CALL PLOTS (IDEF,IOPORT,MODEL)                                    80386
      JZ = 1                                                            PLTINC
      DO  50  K=1,NPLT                                                  POSTPR
      JX = 1                                                            POSTPR
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```
      IF  (MX(2,K).EQ.0)  GO TO 42                                      POSTPR
      JZ = JZ + 1                                                       POSTPR
      JX = JZ                                                           POSTPR
      IF  (Z(1,JX).EQ.0.0 .OR. MX(2,K).GE.0)  GO TO 42                  POSTPR
      DO  41  I=2,NPTS                                                  POSTPR
   41 Z(I,JX) = Z(I,JX) - Z(1,JX)                                       POSTPR
      Z(1,JX) = 0.0                                                     POSTPR
   42 NYPLT = NYP(K)                                                    POSTPR
      DO  44  J=1,NYPLT                                                 POSTPR
      JY = JZ + J                                                       POSTPR
      IF  (Z(1,JY).EQ.0.0 .OR. MY(2,J,K).GE.0)  GO TO 44                POSTPR
      DO  43  I=2,NPTS                                                  POSTPR
   43 Z(I,JY) = Z(I,JY) - Z(1,JY)                                       POSTPR
      Z(1,JY) = 0.0                                                     POSTPR
   44 CONTINUE                                                          POSTPR
      NXK = NX(K)                                                       POSTPR
      NYK = NY(K)                                                       POSTPR
      XOK = X0(K)                                                       POSTPR
      YOK = Y0(K)                                                       POSTPR
      XNK = XN(K)                                                       POSTPR
      YNK = YN(K)                                                       POSTPR
      XLK = XL(K)                                                       POSTPR
      YLK = YL(K)                                                       POSTPR
      XSK = XS(K)                                                       POSTPR
      YSK = YS(K)                                                       POSTPR
      NXLABK = NXLAB(K)                                                 POSTPR
      NYLABK = NYLAB(K)                                                 POSTPR
      NPLB1K = NPLB1(K)                                                 POSTPR
      NPLB2K = NPLB2(K)                                                 POSTPR
      CALL SLPLOT(Z(1,JX  ), NXK, XOK, XNK, XLK, XSK, XLAB(1,K), NXLABK,POSTPR
     *            Z(1,JZ+1), NYK, YOK, YNK, YLK, YSK, YLAB(1,K), NYLABK,POSTPR
     *             NPTS,NYPLT,NZD1,PLB1(1,K),NPLB1K,PLB2(1,K),NPLB2K)   POSTPR
C                                                                       POSTPR
C     INSERT ANY CODE REQUIRED BY YOUR SYSTEM TO ADVANCE PLOT PAGES HEREPOSTPR
C                                                                       POSTPR
      IF(NPRT(31).EQ.1) GO TO 444                                       CHGIII
      X00 = -0.5*(XSK-(XLK-0.5)) + XLK + 3.0                            FXPLOT
      Y00 = -0.5*(YSK-(YLK-1.0))                                        FXPLOT
      CALL PLOT (X00,Y00,-3)                                            FXPLOT
   50 JZ = JZ + NYPLT                                                   POSTPR
  444 CONTINUE                                                          CHGIII
C                                                                       POSTPR
C     INSERT ANY PLOT TERMINATION CODE REQUIRED BY YOUR SYSTEM HERE.    POSTPR
C                                                                       POSTPR
      CALL PLOT(12.0,0.0,999)                                           PECONV
   98 CALL ELTIME (2,36)                                                POSTPR
   99 RETURN                                                            POSTPR
      END                                                               POSTPR
```

```
      SUBROUTINE PRINT(SUB)                                             PRINT
C                                                 REV IV    07/24/86SLIP
C     SUBROUTINE TO PRINT SEGMENT LINEAR AND ANGULAR                    PRINT
C     POSITIONS, VELOCITIES AND ACCELERATIONS FOR A GIVEN TIME.         PRINT
C                                                                       PRINT
C     ARGUMENTS                                                         PRINT
C        SUB: CALLING SUBROUTINE NAME                                   PRINT
C                                                                       PRINT
      IMPLICIT REAL*8(A-H,O-Z)                                          PRINT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           PRINT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),PRINT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       PRINT
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     PRINT
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    PRINT
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),PRINT
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   PRINT
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),PRINT
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              PRINT
     *               KQ1(12),KQ2(12),KQTYPE(12)                         PRINT
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           PRINT
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       PRINT
     *               JOINT(30),CGS(30),JS(30)                           PRINT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      PRINT
      LOGICAL*1 CGS,JS                                                  PRINT
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         PRINT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      COMMON/TEMPVS/ YPR(3),T1(3),T2(3),HH(3),T3(3,3),SKE(3),TKE(3),V   KINETIC
     *              ,DMMY(35085)                                        80386
C                                                                       PRINT
      IPC = 1                                                           PRINT
      TMSEC = 1000.0*TIME                                               PRINT
      WRITE (6,11) IPC,SUB,TMSEC,NPG                                    PAGE
      NPG=NPG+1                                                         PAGE
   11 FORMAT (I1,6X,A6,' FUNCTIONS FOR TIME=',                          CHGIII
     *         F10.3,' MSEC',75X,'PAGE',I5/)                            PAGE
      WRITE (6,760)                                                     CHGIII
  760 FORMAT(1X,23X,'(INERTIAL)',29X,'(LOCAL)',35X,'(LOCAL)')           CHGIII
      WRITE (6,12) UNITT,UNITT                                          PRINT
   12 FORMAT(19X,'ANGULAR ROTATION (DEG)',                              PRINT
     *        12X,'ANGULAR VELOCITY (RAD/',A4,')',                      PRINT
     *        12X,'ANGULAR ACCELERATION (RAD/',A4,'**2)'/               PRINT
     *        ' SEGMENT',9X,'YAW' ,7X,'PITCH',7X,'ROLL',                PRINT
     *        11X,'X',11X,'Y',11X,'Z',15X,'X',13X,'Y',13X,'Z'/)         PRINT
      MBAG = NVEH + NBAG                                                PRINT
      DO  20  I=1,MBAG                                                  PRINT
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```
      IF  (LPMI(I).EQ.0)  GO TO 19                                      PRINT
      CALL DOT33 (DPMI(1,1,I),D(1,1,I),T3)                              PRINT
      CALL DOT31(DPMI(1,1,I),WMEG(1,I),T1)                              FIXPRT
      CALL DOT31(DPMI(1,1,I),WMEGD(1,I),T2)                             FIXPRT
      CALL YPRDEG (T3,YPR)                                              PRINT
      WRITE (6,31) I,SEG(I),YPR,(T1(K),K=1,3),(T2(K),K=1,3)             FIXPRT
      GO TO 20                                                          PRINT
   19 CALL YPRDEG (D(1,1,I),YPR)                                        PRINT
      WRITE  (6,31)  I,SEG(I),YPR,(WMEG(K,I),K=1,3),(WMEGD(K,I),K=1,3)  FIXPRT
   20 CONTINUE                                                          FIXPRT
      WRITE(6,770)                                                      CHGIII
  770 FORMAT(//,1X,23X,'(INERTIAL)',27X,'(INERTIAL)',32X,'(INERTIAL)')  CHGIII
      WRITE  (6,22)  UNITL,UNITL,UNITT                                  PRINT
   22 FORMAT(18X,'LINEAR POSITION (',A4,')',                            CHGIII
     *          13X,'LINEAR VELOCITY (',A4,'/',A4,')',                  PRINT
     *          16X,'LINEAR ACCELERATIONS (G''S)'/                      PRINT
     *       ' SEGMENT',10X,'X',10X,'Y',10X,'Z',                        PRINT
     *       13X,'X',11X,'Y',11X,'Z',15X,'X',13X,'Y',13X,'Z'/)          PRINT
      DO  30  I=1,MBAG                                                  PRINT
      DO  29  K=1,3                                                     PRINT
   29 T1(K) = SEGLA(K,I)/G                                              PRINT
   30 WRITE (6,31) I,SEG(I),(SEGLP(K,I),K=1,3),(SEGLV(K,I),K=1,3),T1    PRINT
   31 FORMAT(I3,1X,A4,3X,3F11.4,3X,3F12.5,3X,3F14.6)                    PRINT
      IF (NSEG.GT.6) WRITE (6,32) NPG                                   PAGE
      IF (NSEG.GT.6) NPG=NPG+1                                          PAGE
   32 FORMAT('1',122X,'PAGE',I5)                                        PAGE
      WRITE(6,775)                                                      CHGIII
  775 FORMAT(//,1X,23X,'(INERTIAL)',29X,'(LOCAL)')                      CHGIII
      WRITE (6,33) UNITL,UNITT,UNITT,UNITM,UNITL                        KINETIC
   33 FORMAT(18X,'U1 ARRAY (',A4,'/',A4,'**2)',                         KINETIC
     *          14X,'U2 ARRAY (RAD/',A4,'**2)',                         KINETIC
     *          25X,'KINETIC ENERGY'/                                   KINETIC
     *          15X,'EXTERNAL LINEAR ACCELERATIONS',                    KINETIC
     *           8X,'EXTERNAL ANGULAR ACCELERATIONS',                   KINETIC
     *          22X,'(',A4,'-',A4,')'/                                  KINETIC
     * ' SEGMENT',10X,'X',10X,'Y',10X,'Z',13X,'X',11X,'Y',11X,'Z',      KINETIC
     *           14X,'LINEAR',7X,'ANGULAR',7X,'TOTAL'/)                 KINETIC
      DO 80 J=1,3                                                       KINETIC
80    TKE(J)=0.0                                                        KINETIC
      DO 34 I=1,NSEG                                                    PRINT
      V=SEGLV(1,I)**2+SEGLV(2,I)**2+SEGLV(3,I)**2                       KINETIC
      SKE(1)=0.5*W(I)*V/G                                               KINETIC
      SKE(2)=0.0                                                        KINETIC
      DO 81 J=1,3                                                       KINETIC
81    SKE(2)=SKE(2)+0.5*PHI(J,I)*WMEG(J,I)**2                           KINETIC
      SKE(3)=SKE(1)+SKE(2)                                              KINETIC
      DO 82 J=1,3                                                       KINETIC
82    TKE(J)=TKE(J)+SKE(J)                                              KINETIC
      IF  (LPMI(I).EQ.0) GO TO 73                                       FIXPRT
      CALL DOT31 (DPMI(1,1,I),U2(1,I),T1)                               FIXPRT
      WRITE (6,61) I,SEG(I),(U1(K,I),K=1,3),                            KINETIC
     *             (T1(K),K=1,3),(SKE(K),K=1,3)                         KINETIC
```

```
      GO TO 34                                                            PRINT
   73 CONTINUE                                                            PRINT
      WRITE (6,61) I,SEG(I),(U1(K,I),K=1,3),                              KINETIC
     *              (U2(K,I),K=1,3),(SKE(K),K=1,3)                        KINETIC
   61 FORMAT(I3,1X,A4,3X,3(D11.4,1X),3X,3(D12.5,1X),3X,3(D12.5,1X))       KINETIC
   34 CONTINUE                                                            FIXPRT
      WRITE(6,83) (TKE(K),K=1,3)                                          KINETIC
83    FORMAT(1X,98X,'TOTAL BODY KINETIC ENERGY'/                          KINETIC
     *       1X,90X,3(1X,D12.5))                                          KINETIC
      IF (NJNT.LE.0) GO TO 39                                             PRINT
      WRITE(6,776)                                                        CHGIII
  776 FORMAT(//,1X,27X,'(INERTIAL)',27X,'(INERTIAL)')                     CHGIII
      WRITE (6,35) UNITM,UNITL,UNITM,UNITT                                PRINT
   35 FORMAT(24X,'JOINT FORCES (',A4,')',                                 CHGIII
     *          15X,'JOINT TORQUES (',2A4,')',                            PRINT
     *           9X,'RELATIVE ANGULAR'/                                   PRINT
     *'  JOINT  IPIN',9X,'X',10X,'Y',10X,'Z',13X,'X',11X,'Y',11X,'Z',     PRINT
     *           7X,'VELOCITY (RAD/',A4,')'/)                             PRINT
      DO 36 J=1,NJNT                                                      PRINT
      IPINJ = IPIN(J)                                                     PRINT
      IF (IABS(IPIN(J)).EQ.4) IPINJ = IEULER(J)                           PRINT
      DO 137 II=1,3                                                       MISC
137   T1(II)=-TQ(II,J)                                                    MISC
      WRITE (6,37) J,JOINT(J),IPINJ,(F(K,J),K=1,3),(T1(K),K=1,3),WJ(J)    MISC
   37 FORMAT(I3,1X,A4,I4,7X,3(D10.3,1X),3X,3(D11.4,1X),3X,F13.3)          FIXPRT
   36 CONTINUE                                                            FIXPRT
   39 IF (NQ.LE.0) GO TO 99                                               PRINT
      WRITE (6,41)                                                        CHGIII
      WRITE (6,47)                                                        CHGIII
   47 FORMAT(1X,45X,'(INERTIAL)')                                         CHGIII
      WRITE (6,49) UNITM,UNITL                                            CHGIII
   41 FORMAT(///' OTHER CONSTRAINT FORCES',/)                             CHGIII
   49 FORMAT(1X,' NO.  TYPE   SEG1  SEG2',                                CHGIII
     *       15X,'CONSTRAINT FORCE (',A4,')',                             PRINT
     *       16X,'DISTANCE (',A4,')'/)                                    PRINT
      ICH = 0                                                             FIXPRT
      DO 50 J=1,NQ                                                        PRINT
      IF (KQTYPE(J).NE.5) ICH = 0                                         FIXPRT
      IF (KQTYPE(J).LT.0) GO TO 50                                        PRINT
      IF (KQTYPE(J).EQ.5) ICH = ICH + 1                                   FIXPRT
      IF (ICH.EQ.2) GO TO 50                                              FIXPRT
      M = KQ1(J)                                                          PRINT
      N = KQ2(J)                                                          PRINT
      CALL DOT31(D(1,1,M),RK1(1,J),T1)                                    PRINT
      CALL DOT31(D(1,1,N),RK2(1,J),T2)                                    PRINT
      S1 = 0.0                                                            PRINT
      DO 42 I=1,3                                                         PRINT
      HH(I) = SEGLP(I,M)+T1(I) - SEGLP(I,N)-T2(I)                         PRINT
   42 S1 = S1 + HH(I)**2                                                  PRINT
      SQS1 = DSQRT(S1)                                                    PRINT
      WRITE (6,43) J,KQTYPE(J),SEG(M),SEG(N),(QQ(I,J),I=1,3),SQS1         PRINT
   43 FORMAT(I4,I6,4X,A4,2X,A4,3X,3G15.7,6X,G15.7)                        PRINT
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```
50 CONTINUE                                                          PRINT
99 IF  (NPRT(28).LE.0)  NPRT(28) = -1                                PRINT
   RETURN                                                            PRINT
   END                                                               PRINT
```

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      SUBROUTINE PRIPLT                                                 PRIPLT
C                                                REV IV    07/24/86SLIP
C     PRODUCES PRINTER PLOT OF Y-Z PLANE VIEW AND X-Z PLANE VIEW OF    PRIPLT
C     BODY SEGMENT CGS, JOINTS AND SELECTED POINTS OF VEHICLE COMPONENTSPRIPLT
C                                                                       PRIPLT
      IMPLICIT REAL*8 (A-H,O-Z)                                         PRIPLT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           PRIPLT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),PRIPLT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       PRIPLT
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     PRIPLT
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    PRIPLT
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(   6),  PRIPLT
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), PRIPLT
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               PRIPLT
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           PRIPLT
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       PRIPLT
     *               JOINT(30),CGS(30),JS(30)                           PRIPLT
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       PRIPLT
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          PRIPLT
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         PRIPLT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      PRIPLT
      LOGICAL*1 CGS,JS                                                  PRIPLT
      COMMON/TEMPVS/ TEMP1(3),TEMP(3),TEMP2(3),CJOINT(3,30),BSN(2),     PRIPLT
     *               PLOTYZ(96,55),PLOTXZ(96,55),PLOTXY(96,55)          PRIPLT
     *              ,DMMY(33032)                                        80386
      LOGICAL*1 PLOTYZ,PLOTXZ,PLOTXY,CHARS(7),BLANK,BCHAR               PRIPLT
      LOGICAL   NPRT5,NPRT6,NPRT7                                       PRIPLT
      DATA CHARS/'.','+','@','!','_','-','*'/, BLANK/' '/               PRIPLT
      DATA ISTEP/0/ , NPLTI/96/ , NPLTJ/55/                             PRIPLT
C                                                                       PRIPLT
C     DETERMINE IF PLOTTING IS TO BE DONE FOR THIS TIME STEP.           PRIPLT
C                                                                       PRIPLT
      ISTEP = ISTEP+1                                                   PRIPLT
      NPRT5 = (NPRT(5).EQ.1)                                            PRIPLT
      IF (NPRT(5).GT.1) NPRT5 = (MOD(ISTEP,NPRT(5)).EQ.1)               PRIPLT
      NPRT6 = (NPRT(6).EQ.1)                                            PRIPLT
      IF (NPRT(6).GT.1) NPRT6 = (MOD(ISTEP,NPRT(6)).EQ.1)               PRIPLT
      NPRT7 = (NPRT(7).EQ.1)                                            PRIPLT
      IF (NPRT(7).GT.1) NPRT7 = (MOD(ISTEP,NPRT(7)) EQ 1)               PRIPLT
      IF  (.NOT.NPRT5 .AND. .NOT.NPRT6 .AND  NOT.NPRT7)  GO TO 99       PRIPLT
      CALL ELTIME(1, 4)                                                 PRIPLT
C                                                                       PRIPLT
C     BLANK OUT PLOT ARRAYS.                                            PRIPLT
C                                                                       PRIPLT
      DO  10  J=1,NPLTJ                                                 PRIPLT
      PLOTYZ(1,J) = CHARS(6)                                            PRIPLT
      PLOTXZ(1,J) = CHARS(6)                                            PRIPLT
      PLOTXY(1,J) = CHARS(6)                                            PRIPLT
      DO  10  I=2,NPLTI                                                 PRIPLT
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      PLOTYZ(I,J) = BLANK                                               PRIPLT
      PLOTXZ(I,J) = BLANK                                               PRIPLT
   10 PLOTXY(I,J) = BLANK                                               PRIPLT
C                                                                       PRIPLT
C     PLOT VEHICLE REFERENCE ORIGIN USING SYMBOL(*).                    PRIPLT
C                                                                       PRIPLT
      CALL PLTXYZ (SEGLP(1,NVEH),CHARS(7))                              PRIPLT
C                                                                       PRIPLT
C     PLOT CG OF BODY SEGMENTS USING SEGMENT SYMBOLS.                   PRIPLT
C                                                                       PRIPLT
      DO 20  I=1,NSEG                                                   PRIPLT
   20 CALL PLTXYZ(SEGLP(1,I),CGS(I))                                    PRIPLT
C                                                                       PRIPLT
C     COMPUTE AND PLOT JOINT LOCATIONS USING JOINT SYMBOLS.             PRIPLT
C                                                                       PRIPLT
      IF  (NJNT.EQ.0)  GO TO 40                                         PRIPLT
      DO  31  J=1,NJNT                                                  PRIPLT
      I = IABS(JNT(J))                                                  PRIPLT
      IF  (I.LE.0)  GO TO 31                                            PRIPLT
      CALL DOT31(D(1,1,I),SR(1,2*J-1),TEMP)                             PRIPLT
      DO 30 L=1,3                                                       PRIPLT
   30 CJOINT(L,J) = TEMP(L)+SEGLP(L,I)                                  PRIPLT
      CALL PLTXYZ (CJOINT(1,J),JS(J))                                   PRIPLT
   31 CONTINUE                                                          PRIPLT
      IF  (NPRT(13).NE.0)  WRITE (6,32) ((CJOINT(I,J),I=1,3),J=1,NJNT)  PRIPLT
   32 FORMAT ('0 JOINT POSITIONS'/(1X,9F14.4))                          PRIPLT
C                                                                       PRIPLT
C     PLOT BELT ANCHOR, FIXED AND TANGENT POINTS USING SYMBOL(.).       PRIPLT
C                                                                       PRIPLT
   40 IF  (NBLT.LE.0)  GO TO 50                                         PRIPLT
      DO  43  J=1,NBLT                                                  PRIPLT
      IF  (MNBLT(J).LE.0)  GO TO 43                                     PRIPLT
      M1 = MBLT(1,1,J)                                                  PRIPLT
      M2 = MBLT(2,1,J)                                                  PRIPLT
      M3 = MBLT(3,1,J)                                                  PRIPLT
      DO  41  I=1,3                                                     PRIPLT
   41 TEMP1(I) = BELT(I+6,J) + BD(I+3,M3)                               PRIPLT
      CALL DOT31 (D(1,1,M2),TEMP1,TEMP)                                 PRIPLT
      CALL DOT31 (D(1,1,M1),BELT(1,J),TEMP1)                            PRIPLT
      CALL DOT31 (D(1,1,M1),BELT(4,J),TEMP2)                            PRIPLT
      DO  42  I=1,3                                                     PRIPLT
      TEMP1(I) = TEMP1(I) + SEGLP(I,M1)                                 PRIPLT
      TEMP2(I) = TEMP2(I) + SEGLP(I,M1)                                 PRIPLT
   42 TEMP (I) = TEMP (I) + SEGLP(I,M2)                                 PRIPLT
      CALL PLTXYZ (TEMP1     ,CHARS(1))                                 PRIPLT
      CALL PLTXYZ (TEMP2     ,CHARS(1))                                 PRIPLT
      CALL PLTXYZ (TEMP      ,CHARS(1))                                 PRIPLT
      CALL PLTXYZ (TPTS(1,J),CHARS(1))                                  PRIPLT
      CALL PLTXYZ (TPTS(4,J),CHARS(1))                                  PRIPLT
   43 CONTINUE                                                          PRIPLT
C                                                                       PRIPLT
C     PLOT POINTS IN PLAY ON HARNESS-BELT SYSTEMS USING SYMBOL(.).      PRIPLT
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C                                                                       PRIPLT
   50 IF  (NHRNSS.LE.0)  GO TO 60                                       PRIPLT
      J1 = 1                                                            PRIPLT
      K1 = 1                                                            PRIPLT
      DO  54  NH=1,NHRNSS                                               PRIPLT
      IF  (NBLTPH(NH).LE.J)  GO TO 54                                   PRIPLT
      J2 = J1 + NBLTPH(NH) - 1                                          PRIPLT
      DO  53  NB=J1,J2                                                  PRIPLT
      IF  (NPTPLY(NB).LE.0)  GO TO 53                                   PRIPLT
      K2 = K1 + NPTPLY(NB) - 1                                          PRIPLT
      DO  52   K=K1,K2                                                  PRIPLT
      KI = NL(1,K)                                                      PRIPLT
      KS = IABS(IBAR(1,KI))                                             PRIPLT
      IF  (KS.GT.100)  KS = MOD(KS,100)                                 PRIPLT
      CALL DOT31 (D(1,1,KS),BAR(4,KI),TEMP1)                            PRIPLT
      CALL DOT31 (D(1,1,KS),BAR(7,KI),TEMP2)                            PRIPLT
      DO  51  I=1,3                                                     PRIPLT
   51 TEMP(I) = SEGLP(I,KS) + TEMP1(I) + TEMP2(I)                       PRIPLT
   52 CALL PLTXYZ (TEMP,CHARS(1))                                       PRIPLT
      K1 = K2+1                                                         PRIPLT
   53 CONTINUE                                                          PRIPLT
      J1 = J2+1                                                         PRIPLT
   54 CONTINUE                                                          PRIPLT
C                                                                       PRIPLT
C     PLOT CENTER AND END OF AXES OF ELLIPSOIDAL TARGET USING SYMBOLS   PRIPLT
C     (@) FOR CENTER, (-) FOR ENDS OF Z AXIS,(!) FOR ENDS OF X,Y AXES.  PRIPLT
C                                                                       PRIPLT
   60 IF  (NBAG.EQ.0)  GO TO 80                                         PRIPLT
      BSN(1) =  1.0                                                     PRIPLT
      BSN(2) = -1.0                                                     PRIPLT
      DO  68  J=1,NBAG                                                  PRIPLT
      IF  (MNBAG(J).EQ.0)  GO TO 68                                     PRIPLT
      JB = NVEH+J                                                       PRIPLT
      BCHAR = CHARS(5)                                                  PRIPLT
      L2 = 2                                                            PRIPLT
      DO  67  I=1,4                                                     PRIPLT
      IF  (I.EQ.3)  BCHAR = CHARS(4)                                    PRIPLT
      IF  (I.EQ.4)  BCHAR = CHARS(3)                                    PRIPLT
      IF  (I.EQ.4)  L2 = 1                                              PRIPLT
      DO  67  L=1,L2                                                    PRIPLT
      DO  64  K=1,3                                                     PRIPLT
   64 TEMP1(K) = BD(K+3,JB)                                             PRIPLT
      IF  (I.EQ.4)  GO TO 65                                            PRIPLT
      TEMP1(I) = TEMP1(I) + BSN(L)*BD(I,JB)                             PRIPLT
   65 CALL DOT31 (D(1,1,JB),TEMP1,TEMP2)                                PRIPLT
      DO  66  K=1,3                                                     PRIPLT
   66 TEMP2(K) = TEMP2(K) + SEGLP(K,JB)                                 PRIPLT
   67 CALL PLTXYZ (TEMP2,BCHAR)                                          PRIPLT
   68 CONTINUE                                                          PRIPLT
C                                                                       PRIPLT
C     PRINT Y-Z , X-Z AND X-Y PLANE VIEW PLOTS.                         PRIPLT
C                                                                       PRIPLT
```

```
80 TMSC = 1000.0*TIME                                                   PRIPLT
   IF (.NOT.NPRT5) GO TO 83                                             PRIPLT
   WRITE (2,81) TMSC,SEGLP(2,NVEH),SEGLP(3,NVEH)                        PRIPLT
81 FORMAT ('1 T=',F10.3,'   Y0=',F10.5,'   Z0=',F10.5,'   Y-Z PLANE')PRIPLT
   WRITE (2,82) PLOTYZ                                                  PRIPLT
82 FORMAT (2X,96A1)                                                     PRIPLT
83 IF (.NOT.NPRT6) GO TO 85                                             PRIPLT
   WRITE (2,84) TMSC,SEGLP(1,NVEH),SEGLP(3,NVEH)                        PRIPLT
84 FORMAT ('1 T=',F10.3,'   X0=',F10.5,'   Z0=',F10.5,'   X-Z PLANE')PRIPLT
   WRITE (2,82) PLOTXZ                                                  PRIPLT
85 IF (.NOT.NPRT7) GO TO 87                                             PRIPLT
   WRITE (2,86) TMSC,SEGLP(1,NVEH),SEGLP(2,NVEH)                        PRIPLT
86 FORMAT ('1 T=',F10.3,'   X0=',F10.5,'   Y0=',F10.5,'   X-Y PLANE')PRIPLT
   WRITE (2,82) PLOTXY                                                  PRIPLT
87 CALL ELTIME(2, 4)                                                    PRIPLT
99 RETURN                                                               PRIPLT
   END                                                                  PRIPLT
```

```
      SUBROUTINE QSET(F,Y,X,DER,N)                                      QSET
C                                                  REV III.3 10/01/84REVIII
      IMPLICIT REAL*8(A-H,O-Z)                                          QSET
      DIMENSION F(5,3,80),Y(5,3,80),X(3,80),DER(3,80)                   QSET
      DIMENSION T1(3),T2(3),T3(3),T4(3)                                 QSET
      DO  20  I=1,N                                                     QSET
      E1=DSQRT(1.D0 -X(1,I)**2-X(2,I)**2-X(3,I)**2)                     QSET
      E1D=-(X(1,I)*DER(1,I)+X(2,I)*DER(2,I)+X(3,I)*DER(3,I))/E1         QSET
      E2=DSQRT(1.D0-Y(1,1,I)**2-Y(1,2,I)**2-Y(1,3,I)**2)                QSET
      E2D=-(Y(1,1,I)*Y(2,1,I)+Y(1,2,I)*Y(2,2,I)+Y(1,3,I)*Y(2,3,I))/E2   QSET
      UHB=X(1,I)*F(3,1,I)+X(2,I)*F(3,2,I)+X(3,I)*F(3,3,I)               QSET
      UHC=X(1,I)*F(4,1,I)+X(2,I)*F(4,2,I)+X(3,I)*F(4,3,I)               QSET
      UDB=DER(1,I)*F(3,1,I)+DER(2,I)*F(3,2,I)+DER(3,I)*F(3,3,I)         QSET
      UDD=DER(1,I)**2+DER(2,I)**2+DER(3,I)**2                           QSET
      EB=(E1D**2+UDD+UHB)/E1                                            QSET
      EC =  (1.5*(UDB-E1D*EB)+UHC+F(5,1,I)*(E1D**2+UDD))/E1             QSET
      T1(1)=X(2,I)*F(3,3,I)-X(3,I)*F(3,2,I)                             QSET
      T2(1)=X(2,I)*F(4,3,I)-X(3,I)*F(4,2,I)                             QSET
      T3(1)=X(2,I)*Y(1,3,I)-X(3,I)*Y(1,2,I)                             QSET
      T4(1)=X(2,I)*Y(2,3,I)-X(3,I)*Y(2,2,I)                             QSET
      T1(2)=X(3,I)*F(3,1,I)-X(1,I)*F(3,3,I)                             QSET
      T2(2)=X(3,I)*F(4,1,I)-X(1,I)*F(4,3,I)                             QSET
      T3(2)=X(3,I)*Y(1,1,I)-X(1,I)*Y(1,3,I)                             QSET
      T4(2)=X(3,I)*Y(2,1,I)-X(1,I)*Y(2,3,I)                             QSET
      T1(3)=X(1,I)*F(3,2,I)-X(2,I)*F(3,1,I)                             QSET
      T2(3)=X(1,I)*F(4,2,I)-X(2,I)*F(4,1,I)                             QSET
      T3(3)=X(1,I)*Y(1,2,I)-X(2,I)*Y(1,1,I)                             QSET
      T4(3)=X(1,I)*Y(2,2,I)-X(2,I)*Y(2,1,I)                             QSET
      DO 20 J=1,3                                                       QSET
      F(3,J,I)=E1*F(3,J,I)-T1(J)+EB*X(J,I)                              JTF984
      F(4,J,I)=E1*F(4,J,I)-T2(J)+EC*X(J,I)                              JTF984
      Y(3,J,I)=E1*Y(1,J,I)-T3(J)-E2*X(J,I)                              JTF984
   20 Y(4,J,I)=E1*Y(2,J,I)-T4(J)-E2D*X(J,I)                             JTF984
      RETURN                                                            QSET
      END                                                               QSET
```

```
      SUBROUTINE QUAT(ANG,Q)                                            QUAT
C                                                REV IV    07/23/86TWOPI
C     COMPUTES QUATERNIONS FROM YAW, PITCH, ROLL ANGLES IN DEGREES      QUAT
      IMPLICIT REAL *8(A-H,O-Z)                                         QUAT
      DIMENSION ANG(3),Q(4),R(4),T(3)                                   QUAT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         QUAT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      A = 0.5*ANG(1)*RADIAN                                             QUAT
      Q(1) = DCOS(A)                                                    QUAT
      Q(2) = 0.0                                                        QUAT
      Q(3) = 0.0                                                        QUAT
      Q(4) = DSIN(A)                                                    QUAT
      K = 3                                                             QUAT
      DO 10 I = 2,3                                                     QUAT
      A = 0.5*ANG(I)*RADIAN                                             QUAT
      R(1) = DCOS(A)                                                    QUAT
      R(2) = 0.0                                                        QUAT
      R(3) = 0.0                                                        QUAT
      R(4) = 0.0                                                        QUAT
      R(K) = DSIN(A)                                                    QUAT
      DOT = Q(2)*R(2) + Q(3)*R(3) + Q(4)*R(4)                           QUAT
      CALL CROSS(Q(2),R(2),T)                                           QUAT
      DO 5 J = 2,4                                                      QUAT
    5 Q(J) = Q(1)*R(J) + R(1)*Q(J) + T(J-1)                             QUAT
      Q(1) = Q(1)*R(1) - DOT                                            QUAT
   10 K = 2                                                             QUAT
      SUM = DSQRT(Q(1)**2 + Q(2)**2 + Q(3)**2 + Q(4)**2)                QUAT
      DO 12 I = 1,4                                                     QUAT
   12  Q(I) = Q(I)/SUM                                                  QUAT
       RETURN                                                           QUAT
      END                                                               QUAT
```

```
      DOUBLE PRECISION FUNCTION RCRT(A,PL,Z,IP)                         RCRT
C                                                   REV 03    07/19/73RCRT
C     COMPUTES THE RADIUS OF CURVATURE AT POINT Z OF ELLIPSOID A        RCRT
C     IN THE PLANE PL(I,IP) WHERE                                       RCRT
C                                                                       RCRT
C          A: 3X3 MATRIX DEFINING ELLIPSOID.                            RCRT
C         PL: 4X3 MATRIX CONTAINING THREE ORTHONORMAL VECTORS.          RCRT
C          Z: 3 COORDINATES OF POINT ON THE ELLIPSOID                   RCRT
C             AS MEASURED FROM CENTER OF ELLIPSOID                      RCRT
C         IP: IDENTIFIES THE NORMAL VECTOR OF PLANE IN WHICH THE        RCRT
C             RADIUS OF CURVATURE IS DESIRED.                           RCRT
C                                                                       RCRT
      IMPLICIT REAL*8 (A-H,O-Z)                                         RCRT
      DIMENSION A(3,3),PL(4,3),Z(3),T(5)                                RCRT
      DO 10  I=1,5                                                      RCRT
   10 T(I) = 0.0                                                        RCRT
      M = IP+1                                                          RCRT
      N = IP+2                                                          RCRT
      IF(M.GT.3) M = M-3                                                RCRT
      IF(N.GT.3) N = N-3                                                RCRT
      DO 30  I=1,3                                                      RCRT
      S1 = 0.                                                           RCRT
      S2 = 0.                                                           RCRT
      DO 20  J=1,3                                                      RCRT
      S1 = S1+A(I,J)*PL(J,M)                                            RCRT
   20 S2 = S2+A(I,J)*PL(J,N)                                            RCRT
      T(1) = T(1)+S1*Z(I)                                               RCRT
      T(2) = T(2)+S2*Z(I)                                               RCRT
      T(3) = T(3)+S1*PL(I,M)                                            RCRT
      T(4) = T(4)+S2*PL(I,N)                                            RCRT
   30 T(5) = T(5)+S1*PL(I,N)                                            RCRT
      W = DSQRT(T(1)**2+T(2)**2)                                        RCRT
      T(1) = T(1)/W                                                     RCRT
      T(2) = T(2)/W                                                     RCRT
      RCRT = W/(T(3)*T(2)**2-2.0*T(1)*T(2)*T(5)+T(4)*T(1)**2)           RCRT
      IF(RCRT.LT.0.0) RCRT = -RCRT                                      RCRT
      RETURN                                                            RCRT
      END                                                               RCRT
```

```
      SUBROUTINE ROT (A,L,TH)                                           ROT
C                                                   REV IV    07/23/86TWOPI
C     COMPUTES ROTATION MATRIX A FOR ANGLE TH                           ROT
C     ABOUT X,Y OR Z AXIS AS L = 1,´, OR 3.                             ROT
C                                                                       ROT
C       ARGUMENTS:                                                      ROT
C         A: 3X3 ROTATION MATRIX TO BE COMPUTED.                        ROT
C         L: 1,2 OR 3 TO ROTATE ABOUT X,Y OR Z AXIS.                    ROT
C         TH: ANGLE OF ROTATION IN RADIANS.                             ROT
C                                                                       ROT
      IMPLICIT REAL*8 (A-H,O-Z)                                         ROT
      DIMENSION  A(3,3)                                                 ROT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         ROT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      C=DCOS(TH)                                                        ROT
      S=DSIN(TH)                                                        ROT
      IF (DABS(C) .LT.EPS(8)) C=0.0                                     CONVER
      IF (DABS(S).LT.EPS(8)) S=0.0                                      CONVER
      ONE = 1.0                                                         ROT
      IF  (1.0-DABS(C).LT.EPS(8))  C = DSIGN(ONE,C)                     CONVER
      IF  (1.0-DABS(S).LT.EPS(8))  S = DSIGN(ONE,S)                     CONVER
      IF (L.EQ.2) S = -S                                                ROT
      DO 30 I=1,3                                                       ROT
      IF(I.EQ.3)GO TO 20                                                ROT
      DO 10 J=I,2                                                       ROT
      A(I,J+1)=0.0                                                      ROT
      A(J+1,I)=0.0                                                      ROT
      IF(I+J+L.NE.5)GO TO 10                                            ROT
      A(I,J+1)=S                                                        ROT
      A(J+1,I)=-S                                                       ROT
   10 CONTINUE                                                          ROT
   20 A(I,I)= C                                                         ROT
      IF(I.EQ.L)A(I,I)=1.0                                              ROT
   30 CONTINUE                                                          ROT
      RETURN                                                            ROT
      END                                                               ROT
```

```
      SUBROUTINE ROTATE                                                  ROTATE
C                                                      REV IV    02/20/87HYPER
C     THE PURPOSE OF THIS ROUTINE IS TO TRANSFORM THOSE VARIABLES THAT  ROTATE
C     HAVE BEEN SUPPLIED IN LOCAL GEOMETRIC COORDINATES TO PRINCIPAL     ROTATE
C     AXES COORDINATES AS INDICATED BY LPMI(I) # 0 FOR I = 1 TO NSEG.    ROTATE
C                                                                        ROTATE
      IMPLICIT REAL*8 (A-H,O-Z)                                          ROTATE
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,            ROTATE
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                  ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)         TTHKREF
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60),  SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),      ROTATE
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)     ROTATE
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)            EDGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),ROTATE
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)        ROTATE
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6),  ROTATE
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6),  ROTATE
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)                ROTATE
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),    ROTATE
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),ROTATE
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),               ROTATE
     *               KQ1(12),KQ2(12),KQTYPE(12)                          ROTATE
      COMMON/DAMPER/ APSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)ROTATE
      COMMON/WINDFR/ UTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),     WINDOP
     *               MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)        WINDOP
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),        ROTATE
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),           ROTATE
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)          ROTATE
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)WINDROT
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),        FXHROT
     *               FE(3,30),TQE(3,30),CONST(5,30)                      FXHROT
      COMMON/TEMPVS/ T1(3),T3(3,3),LBD(40),T2(3),T4(3,3),DMMY(35069)     80386
C                                                                        ROTATE
C     TRANSFORM DIRECTION COSINE MATRICEES D FROM INPUT CARDS G.3.       ROTATE
C                                                                        ROTATE
      LTEST = 0                                                          ROTATE
      DO  20  J=1,30                                                     ROTATE
      IF  (J.GT.NSEG)  LPMI(J) = 0                                       ROTATE
      IF  (LPMI(J).EQ.0)  GO TO 20                                       ROTATE
      LTEST = 1                                                          ROTATE
      DO  12  I=1,3                                                      ROTATE
      T1(I) = WMEG(I,J)                                                  ROTATE
      DO  12  K=1,3                                                      ROTATE
   12 T3(I,K) = D(I,K,J)                                                 ROTATE
      CALL MAT33 (DPMI(1,1,J),T3,D(1,1,J))                               ROTATE
      CALL MAT31 (DPMI(1,1,J),T1,WMEG(1,J))                              ROTATE
   20 CONTINUE                                                           ROTATE
      IF  (LTEST.EQ.0)  GO TO 99                                         ROTATE
C                                                                        ROTATE
C     TRANSFORM SR,HT AND HB FROM INPUT CARDS B.3.                       ROTATE
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C                                                                       ROTATE
      IF  (NJNT.LE.0)  GO TO 31                                         ROTATE
      DO  30  J=1,NJNT                                                  ROTATE
      I = IABS(JNT(J))                                                  ROTATE
      M = 2                                                             SLIP
      IF (IABS(IPIN(J)).GT.4) M = 3                                     SLIP
      DO  24  K=1,2                                                     ROTATE
      IF  (I.EQ.0 .OR. LPMI(I).EQ.0)  GO TO 24                          ROTATE
      IJ = 2*J-2+K                                                      ROTATE
      DO  22  LI=1,3                                                    ROTATE
      T1(LI) = SR(LI,IJ)                                                ROTATE
      T2(LI) = HB(LI,IJ)                                                FXHROT
      DO  22  LJ=1,3                                                    ROTATE
      T4(LI,LJ) = HIR(LI,LJ,IJ+30)                                      FXHROT
   22 T3(LI,LJ) = HT(LI,LJ,IJ)                                          ROTATE
      CALL MAT31 (DPMI(1,1,I),T1,SR(1,IJ))                              ROTATE
      CALL MAT31 (DPMI(1,1,I),T2,HB(1,IJ))                              FXHROT
      CALL MAT33 (DPMI(1,1,I),T3,HT(1,1,IJ))                            ROTATE
      CALL MAT33 (DPMI(1,1,I),T4,HIR(1,1,IJ+30))                        FXHROT
   24 I = J+1                                                           ROTATE
   30 CONTINUE                                                          ROTATE
C                                                                       ROTATE
C     TRANSFORM RK1,RK2 FROM INPUT CARDS D.6.                           ROTATE
C                                                                       ROTATE
   31 IF  (NQ.LE.0)  GO TO 41                                           ROTATE
      K5 = 0                                                            ROTATE
      DO  40  K=1,NQ                                                    ROTATE
      IF  (K5.EQ.1)  GO TO 39                                           ROTATE
      KSEG = KQ1(K)                                                     ROTATE
      IF  (LPMI(KSEG).EQ.0)  GO TO 36                                   ROTATE
      DO  35  I=1,3                                                     ROTATE
   35 T1(I) = RK1(I,K)                                                  ROTATE
      CALL MAT31 (DPMI(1,1,KSEG),T1,RK1(1,K))                           ROTATE
   36 KSEG = KQ2(K)                                                     ROTATE
      IF  (LPMI(KSEG).EQ.0)  GO TO 40                                   ROTATE
      DO  37  I=1,3                                                     ROTATE
   37 T1(I) = RK2(I,K)                                                  ROTATE
      CALL MAT31 (DPMI(1,1,KSEG),T1,RK2(1,K))                           ROTATE
   39 IF  (KQTYPE(K).EQ.5) K5 = 1-K5                                    ROTATE
   40 CONTINUE                                                          ROTATE
C                                                                       ROTATE
C     TRANSFORM APSDM,APSDN FROM INPUT CARDS D.8.                       ROTATE
C                                                                       ROTATE
   41 IF  (NSD.LE.0)  GO TO 151                                         FIXROT
      DO  50  J=1,NSD                                                   ROTATE
      KSEG = MSDM(J)                                                    ROTATE
      IF  (LPMI(KSEG).EQ.0)  GO TO 44                                   ROTATE
      DO  43  I=1,3                                                     ROTATE
   43 T1(I) = APSDM(I,J)                                                ROTATE
      CALL MAT31 (DPMI(1,1,KSEG),T1,APSDM(1,J))                         ROTATE
   44 KSEG = MSDN(J)                                                    ROTATE
      IF  (LPMI(KSEG).EQ.0)  GO TO 50                                   ROTATE
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      DO  45  I=1,3                                                      ROTATE
   45 T1(I) = APSDN(I,J)                                                 ROTATE
      CALL MAT31 (DPMI(1,1,KSEG),T1,APSDN(1,J))                          ROTATE
   50 CONTINUE                                                           ROTATE
C                                                                        FIXROT
C     TRANSFORM QFU AND QFV FROM INPUT CARDS D.9.                        FIXROT
C                                                                        FIXROT
  151 NFORCE = NFVSEG(6)                                                 FIXROT
      IF (NFORCE.LE.0) GO TO 100                                         WINDROT
      DO 152 J=1,NFORCE                                                  FIXROT
      KSEG = IABS(NFVSEG(J))                                             FIXROT
      IF (LPMI(KSEG).EQ.0) GO TO 152                                     FIXROT
      DO 143 I=1,3                                                       FIXROT
      T1(I) = QFU(I,J)                                                   FIXROT
  143 T2(I) = QFV(I,J)                                                   FIXROT
      CALL MAT31 (DPMI(1,1,KSEG),T1,QFU(1,J))                            FIXROT
      CALL MAT31 (DPMI(1,1,KSEG),T2,QFV(1,J))                            FIXROT
  152 CONTINUE                                                           FIXROT
C                                                                        WINDROT
C     ROTATE WIND FORCE FUNCTIONS                                        WINDROT
C                                                                        WINDROT
  100 IF (NWINDF.EQ.0) GOTO 51                                           WINDROT
      DO 101 I=1,NSEG                                                    WINDROT
      IF (MWSEG(1,I).EQ.0) GOTO 101                                      WINDROT
      NT = MWSEG(5,I)                                                    WINDROT
      DO 102 J=1,I-1                                                     WINDROT
      IF (NT.EQ.MWSEG(5,J)) GOTO 101                                     WINDROT
  102 CONTINUE                                                           WINDROT
      KT = NTI(NT)                                                       WINDROT
      RK = TAB(KT)                                                       WINDROT
      IF (RK.NE.0) GOTO 101                                              WINDROT
      NSR = IDINT(TAB(KT+4))                                             WINDROT
      IF (NSR.EQ.0 .OR. LPMI(NSR).EQ.0) GOTO 101                         WINDROT
      NENTRY = TAB(KT+5)                                                 WINDROT
      K1 = KT+6                                                          WINDROT
      K2 = 4*NENTRY+KT+2                                                 WINDROT
      DO 103 K=K1,K2,4                                                   WINDROT
      DO 104 J=1,3                                                       WINDROT
  104 T1(J) = TAB(K+J)                                                   WINDROT
  103 CALL MAT31(DPMI(1,1,NSR),T1,TAB(K+1))                              WINDROT
  101 CONTINUE                                                           WINDROT
C                                                                        ROTATE
C     CHECK PLANE AND ELLIPSOID ASSIGNMENTS ON INPUT CARDS F.1.          ROTATE
C     TRANSFORM PLANE ARRAYS SET UP FROM INPUT CARD D.1.                 ROTATE
C                                                                        ROTATE
   51 DO  52  J=1,40                                                     ROTATE
      LBD(J) = 0                                                         ROTATE
   52 IF  (J.LE.NSEG)  LBD(J) = J                                        ROTATE
      IF  (NPL.LE.0)  GO TO 61                                           ROTATE
      DO  60  J=1,NPL                                                    ROTATE
      IF  (MNPL(J).EQ.0)  GO TO 60                                       ROTATE
      LPL = 0                                                            ROTATE
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      KPL = MNPL(J)                                                    ROTATE
      DO  56  I=1,KPL                                                  ROTATE
      M1 = MPL (1,I,J)                                                 ROTATE
      M2 = MPL (2,I,J)                                                 ROTATE
      M3 = MPL (3,I,J)                                                 ROTATE
      IF  (LPL.EQ.M1 .OR. LPL.EQ.0)  GO TO 54                          ROTATE
      WRITE  (6,53) J,M1,LPL                                           ROTATE
   53 FORMAT('0 INPUT ERROR HAS BEEN DETECTED IN SUBROUTINE ROTATE.'/  ROTATE
     *        '  PLANE NO.',I3,' HAS BEEN ASSIGNED TO BOTH SEGMENTS NO.',ROTATE
     *        I3,' AND NO.',I3,'.'/'  PROGRAM IS BEING TERMINATED.')   ROTATE
      STOP 43                                                          ROTATE
   54 LPL = M1                                                         ROTATE
      IF  (LBD(M3).EQ.M2 .OR. LBD(M3).EQ.0)  GO TO 55                  ROTATE
      WRITE  (6,68)  M3,M2,LBD(M3)                                     ROTATE
      STOP 44                                                          ROTATE
   55 LBD(M3) = M2                                                     ROTATE
   56 CONTINUE                                                         ROTATE
      IF  (LPMI(LPL).EQ.0)  GO TO 60                                   ROTATE
      L = 1                                                            EDGE
      DO  59  K=1,6                                                    EDGE
      IF((K.EQ.3).OR.(K.EQ.6)) L = L-1                                 EDGE
      IF((K.EQ.4).OR.(K.EQ.5)) L = L+1                                 EDGE
      DO  58  I=1,3                                                    ROTATE
      T1(I) = PL(L,J)                                                  EDGE
   58 L=L+1                                                            EDGE
      CALL MAT31 (DPMI(1,1,LPL),T1,PL(L-3,J))                          EDGE
   59 L=L+1                                                            EDGE
   60 CONTINUE                                                         ROTATE
C                                                                      ROTATE
C     CHECK ELLIPSOID ASSIGNMENTS ON INPUT CARDS F.2.                  ROTATE
C     TRANSFORM BELT(L,J) FOR L=1,9 FROM INPUT CARDS D.3.              ROTATE
C                                                                      ROTATE
   61 IF  (NBLT.LE.0)  GO TO 66                                        ROTATE
      DO  65  J=1,NBLT                                                 ROTATE
      IF  (MNBLT(J).EQ.0)  GO TO 65                                    ROTATE
      KBLT = MNBLT(J)                                                  ROTATE
      DO  62  I=1,KBLT                                                 ROTATE
      M1 = MBLT(1,I,J)                                                 ROTATE
      M2 = MBLT(2,I,J)                                                 ROTATE
      M3 = MBLT(3,I,J)                                                 ROTATE
      IF  (LBD(M3).EQ.M2 .OR. LBD(M3).EQ.0)  GO TO 62                  ROTATE
      WRITE  (6,68)  M3,M2,LBD(M3)                                     ROTATE
      STOP 45                                                          ROTATE
   62 LBD(M3) = M2                                                     ROTATE
      IF  (LPMI(M1).EQ.0)  GO TO 63                                    ROTATE
      DO  57  I=1,3                                                    ROTATE
      T3(I,1) = BELT(I  ,J)                                            ROTATE
   57 T3(I,2) = BELT(I+3,J)                                            ROTATE
      CALL MAT31 (DPMI(1,1,M1),T3(1,1),BELT(1,J))                      ROTATE
      CALL MAT31 (DPMI(1,1,M1),T3(1,2),BELT(4,J))                      ROTATE
   63 IF  (LPMI(M2).EQ.0)  GO TO 65                                    ROTATE
      DO  64  I=1,3                                                    ROTATE
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   64 T3(I,3) = BELT(I+6,J)                                          ROTATE
      CALL MAT31 (DPMI(1,1,M2),T3(1,3),BELT(7,J))                    ROTATE
   65 CONTINUE                                                       ROTATE
C                                                                    ROTATE
C     CHECK ELLIPSOID ASSIGNMENTS ON INPUT CARDS F.3.                 ROTATE
C                                                                    ROTATE
   66 DO  70  J=1,NSEG                                               ROTATE
      IF  (MNSEG(J).EQ.0)  GO TO 70                                  ROTATE
      KSEG = MNSEG(J)                                                ROTATE
      DO  69  I=1,KSEG                                               ROTATE
      M1 = MSEG(1,I,J)                                               ROTATE
      M2 = MSEG(2,I,J)                                               ROTATE
      M3 = MSEG(3,I,J)                                               ROTATE
      IF  (LBD(M1).EQ.J .OR. LBD(M1).EQ.0)  GO TO 67                 ROTATE
      WRITE  (6,68)  M1,J,LBD(M1)                                    ROTATE
      STOP 46                                                        ROTATE
   67 LBD(M1) = J                                                    ROTATE
      IF  (LBD(M3).EQ.M2 .OR. LBD(M3).EQ.0)  GO TO 69                ROTATE
      WRITE  (6,68)  M3,M2,LBD(M3)                                   ROTATE
   68 FORMAT('0 INPUT ERROR HAS BEEN DETECTED IN SUBROUTINE ROTATE.'/   ROTATE
     *   '  ELLIPSOID NO.',I3,' HAS BEEN ASSIGNED TO BOTH SEGMENTS NO.',ROTATE
     *       I3,' AND NO.',I3,'.'/'  PROGRAM IS BEING TERMINATED.')     ROTATE
      STOP 47                                                        ROTATE
   69 LBD(M3) = M2                                                   ROTATE
   70 CONTINUE                                                       ROTATE
C                                                                    ROTATE
C     CHECK ELLIPSOID ASSIGNMENTS ON INPUT CARDS F.6.                 ROTATE
C                                                                    ROTATE
      IF  (NBAG.EQ.0)  GO TO 174                                     TGMOD8
      DO  73  J=1,NBAG                                               ROTATE
      IF  (MNBAG(J).EQ.0)  GO TO 73                                  ROTATE
      KBAG = MNBAG(J)                                                ROTATE
      DO  72  I=1,KBAG                                               ROTATE
      M2 = MBAG(2,I,J)                                               ROTATE
      M3 = MBAG(3,I,J)                                               ROTATE
      IF  (LBD(M3).EQ.M2 .OR. LBD(M3).EQ.0)  GO TO 72                ROTATE
      WRITE  (6,68)  M3,M2,LBD(M3)                                   ROTATE
      STOP 50                                                        ROTATE
   72 LBD(M3) = M2                                                   ROTATE
   73 CONTINUE                                                       ROTATE
C                                                                    TGMOD8
C     CHECK ELLIPSOID ASSIGNMENTS ON INPUT CARDS F.7.                 TGMOD8
C                                                                    TGMOD8
  174 IF(NWINDF.EQ.0) GO TO 74                                       TGMOD8
      DO 175 J=1,NSEG                                                TGMOD8
       M1 = IABS(MWSEG(1,J))                                         TGMOD8
       IF(M1.EQ.0) GO TO 175                                         TGMOD8
       M2 = MWSEG(2,J)                                               TGMOD8
       IF(LBD(M2).EQ.M1.OR.LBD(M2).EQ.0) GO TO 172                   TGMOD8
       WRITE(6,68) M2,M1,LBD(M2)                                     TGMOD8
       STOP 48                                                       TGMOD8
  172  LBD(M2) = M1                                                  TGMOD8
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  175 CONTINUE                                                          TGMOD8
C                                                                       ROTATE
C     CHECK ELLIPSOID ASSIGNMENTS ON INPUT CARDS F.8.                   ROTATE
C     TRANSFORM BAR(L,K) FOR L=4,12 FROM INPUT CARDS F.8.D.             ROTATE
C                                                                       ROTATE
   74 IF  (NHRNSS.EQ.0)  GO TO 81                                       ROTATE
      J1 = 1                                                            ROTATE
      K1 = 1                                                            ROTATE
      DO  80  II=1,NHRNSS                                               ROTATE
      IF  (NBLTPH(II).LE.0)  GO TO 80                                   ROTATE
      J2 = J1 + NBLTPH(II) - 1                                          ROTATE
      DO  79  JJ=J1,J2                                                  ROTATE
      IF  (NPTSPB(JJ).LE.0)  GO TO 79                                   ROTATE
      K2 = K1 + NPTSPB(JJ) - 1                                          ROTATE
      DO  78  K=K1,K2                                                   ROTATE
      M2 = MOD(IBAR(1,K),100)                                           ROTATE
      M3 = IBAR(2,K)                                                    ROTATE
      IF (M3.EQ.0) GO TO 88                                             BUTLER1
      IF  (LBD(M3).EQ.M2 .OR. LBD(M3).EQ.0)  GO TO 75                   ROTATE
      WRITE  (6,68)  M3,M2,LBD(M3)                                      ROTATE
      STOP 51                                                           ROTATE
   75 LBD(M3) = M2                                                      ROTATE
   88 IF  (LPMI(M2).EQ.0)  GO TO 78                                     BUTLER1
      DO  77  J=3,9,3                                                   ROTATE
      DO  76  I=1,3                                                     ROTATE
      IJ = I+J                                                          ROTATE
   76 T1(I) = BAR(IJ,K)                                                 ROTATE
   77 CALL MAT31 (DPMI(1,1,M2),T1,BAR(J+1,K))                           ROTATE
   78 CONTINUE                                                          ROTATE
      K1 = K2+1                                                         ROTATE
   79 CONTINUE                                                          ROTATE
      J1 = J2+1                                                         ROTATE
   80 CONTINUE                                                          ROTATE
C                                                                       ROTATE
C     TRANSFORM DATA IN BD ARRAYS FOR ELLIPSOIDS THAT HAVE BEEN ASSIGNEDROTATE
C                                                                       ROTATE
   81 DO  90  J=1,40                                                    ROTATE
      IF  (LBD(J).EQ.0)  GO TO 90                                       ROTATE
      KSEG = LBD(J)                                                     ROTATE
      IF  (LPMI(KSEG).EQ.0)  GO TO 90                                   ROTATE
      L = 4                                                             HYPER
      IF (BD(1,J).LT.0.0) L = 5                                         HYPER
      M = 8                                                             HYPER
      DO  82  I=1,3                                                     ROTATE
      T1(I) = BD(L,J)                                                   HYPER
      L = L + 1                                                         HYPER
      DO 82 K = 1,3                                                     HYPER
      T3(K,I) = BD(M,J)                                                 HYPER
   82 M = M + 1                                                         HYPER
      CALL MAT31 (DPMI(1,1,KSEG),T1,BD(L-3,J))                          HYPER
      IF (BD(1,J).GT.0.0) GO TO 84                                      HYPER
      CALL MAT33 (DPMI(1,1,KSEG),T3,BD(8,J))                            HYPER
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      GO TO 90                                                          HYPER
   84 CALL DOTT33 (BD( 7,J),DPMI(1,1,KSEG),T3)                          HYPER
      CALL MAT33  (DPMI(1,1,KSEG),T3,BD( 7,J))                          ROTATE
      CALL DOTT33 (BD(16,J),DPMI(1,1,KSEG),T3)                          ROTATE
      CALL MAT33  (DPMI(1,1,KSEG),T3,BD(16,J))                          ROTATE
   90 CONTINUE                                                          ROTATE
   99 RETURN                                                            ROTATE
      END                                                               ROTATE
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      SUBROUTINE RSTART(IF,IT)                                          RSTART
C                                              REV IV    07/24/86SLIP
C     THE FIVE FUNCTIONS OF SUBROUTINE RSTART ARE:                      RSTART
C        1. READ INPUT & INITIALIZATION RECORD FROM OLD RESTART TAPE.   RSTART
C        2. WRITE INPUT & INITIALIZATION RECORD ONTO NEW RESTART TAPE.  RSTART
C        3. READ TIME POINT RECORD FROM OLD RESTART TAPE.               RSTART
C        4. READ NEW INPUT DATA FROM INPUT STREAM FOR RESTART.          RSTART
C        5. WRITE TIME POINT RECORD ONTO NEW RESTART TAPE.              RSTART
C                                                                       RSTART
      IMPLICIT REAL*8(A-H,O-Z)                                          RSTART
C                                                                       RSTART
C     ALL LABELED COMMON BLOCKS ARE INCLUDED HERE                       RSTART
C     TO GIVE A COMPLETE SET FOR REFERENCE                              RSTART
C  1                                                                    RSTART
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           RSTART
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      DIMENSION IC1(51)                                                 PAGE
      EQUIVALENCE (IC1(1),NSEG)                                         RSTART
C  2                                                                    RSTART
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      DIMENSION RC2(1888)                                               EDGE
      EQUIVALENCE (RC2(1),PL(1,1))                                      RSTART
C  3                                                                    RSTART
      COMMON/VPOSTN/ ZPLT(3),SPLT(3),AXV(3,6),VATAB(6,501,6),           VEHICL
     *               VT0(6),VDT(6),TIMEV(6),OMEGV(6),NVTAB(6),INDXV(6)  RSTART
      DIMENSION RC3(18084),IC3(12)                                      VEHICL
      EQUIVALENCE (RC3(1),ZPLT(1)),(IC3(1),NVTAB(1))                    RSTART
C  4                                                                    RSTART
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),RSTART
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       RSTART
      DIMENSION RC4(900)                                                RSTART
      EQUIVALENCE (RC4(1),D(1,1,1))                                     RSTART
C  5                                                                    RSTART
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),RSTART
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      DIMENSION RC5A(1296),RC5B(480)                                    SLIP
      EQUIVALENCE (RC5A(1),V1(1,1)),(RC5B(1),F(1,1))                    RSTART
C  6                                                                    RSTART
      COMMON/ABDATA/ ZDEP(3,5),DBR(3,3,5),DPVCTR(3,5),DEPLOY(3,5),      RSTART
     *               AB(3,5),B(9,4,5),ZR(3,4,5),BFB(3,4,5),DRR(9,4,5),  RSTART
     *               VBAGG(5),VSCS(5),SPRK(5),CK(5),CMASS(5),CYMIN(5),  RSTART
     *               CYMOUT(5),BAGPV(5),PD(5),VBAG(5),VOLBP(5),         RSTART
     *               PCYV(5),PCYMIN(5),PVBAG(5),TV1(3,4,5),TV2(3,10,5), RSTART
     *               SWITCH(5),PYMOUT(5),SCALE(5),PREVT,IFULL(6)        RSTART
      DIMENSION RC6A(610),RC6B(271)                                     RSTART
      EQUIVALENCE (RC6A(1),ZDEP(1,1)) , (RC6B(1),CYMIN(1))              RSTART
C  7                                                                    RSTART
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           RSTART
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),       RSTART
     *               JOINT(30),CGS(30),JS(30)                           RSTART
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      RSTART
      LOGICAL*1 CGS,JS                                                  RSTART
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      REAL  RC7,RC7A,XDTE,XCMENT                                            RSTART
      DIMENSION RC7(305),RC7A(348),XDTE(3),XCMENT(40)                       RSTART
      EQUIVALENCE (RC7(1),VPSTTL(1)),(RC7A(1),DATE(1))                      RSTART
C  8                                                                        RSTART
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                             RSTART
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                      TWOPI
      DIMENSION RC8(35)                                                     TWOPI
      EQUIVALENCE (RC8(1),PI)                                               RSTART
C  9                                                                        RSTART
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60),     SLIP
     *              RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),          RSTART
     *              JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)         RSTART
      DIMENSION RC9(2460),IC9(150)                                          SLIP
      EQUIVALENCE (RC9(1),PHI(1,1)),(IC9(1),JNT(1))                         RSTART
C 10                                                                        RSTART
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6),     RSTART
     *              MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6),      RSTART
     *              NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)                    RSTART
      DIMENSION IC10(1614)                                                  RSTART
      EQUIVALENCE (IC10(1),MNPL(1))                                         RSTART
C 11                                                                        RSTART
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),             NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF             RSTART
      DIMENSION RC11(1240),IC11(9)                                          NCFORC
      EQUIVALENCE (RC11(1),PSF(1,1)),(IC11(1),NPANEL(1))                    RSTART
C 12                                                                        RSTART
      COMMON/INTEST/ SGTEST(3.4,30),XTEST(3,120),SEGT(120),REGT(120)        RSTART
      REAL     SEGT                                                         RSTART
      DIMENSION RC12(720)                                                   RSTART
      EQUIVALENCE (RC12(1),SGTEST(1,1,1))                                   RSTART
C 13                                                                        RSTART
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),       RSTART
     *              HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),RSTART
     *              RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),                   RSTART
     *              KQ1(12),KQ2(12),KQTYPE(12)                              RSTART
      DIMENSION RC13(72),IC13(36),RC13A(1212),RC13H(348)                    RSTART
      EQUIVALENCE (RC13(1),RK1(1,1)),(IC13(1),KQ1(1)),                      RSTART
     *           (RC13A(1),A13(1,1,1)),(RC13H(1),HHT(1,1,1))                RSTART
C 14                                                                        RSTART
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      DIMENSION IC14(1304)                                                  BUTLER2
      EQUIVALENCE (IC14(1),MXNTI)                                           RSTART
C 15                                                                        RSTART
      COMMON/COMAIN/VAR(240),DER(240),DT,HO,HMAX,HMIN,RSTIME,               RSTART
     *             ISTEP,NSTEPS,NDINT,NEQ,IRSIN,IRSOUT                      RSTART
      DIMENSION RC15(485),IC15(6)                                           RSTART
      EQUIVALENCE (RC15(1),VAR(1)),(IC15(1),ISTEP)                          RSTART
C 16                                                                        RSTART
      COMMON/CDINT/ UU(4),GH(3,4),                                          RSTART
     *              E(3,240),FF(5,240),GG(5,240),Y(5,240),U(5,240),         RSTART
     *              H,HPRINT,HS,TPRINT,TSTART,ICNT,IDBL,IFLAG,IDMMY         80386
C      NOTE: FF REPLACES F FROM SUBROUTINE DINT.                            RSTART
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      DIMENSION RC16(5541),IC16(3)                                      RSTART
      EQUIVALENCE (RC16(1),UU(1)),(IC16(1),ICNT)                        RSTART
C 17                                                                    RSTART
      COMMON/DAMPER/ APSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)RSTART
      DIMENSION RC17(220),IC17(40)                                      RSTART
      EQUIVALENCE (RC17(1),APSDM(1,1)),(IC17(1),MSDM(1))                RSTART
C 18                                                                    RSTART
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      DIMENSION RC18(1320)                                              JDRIFT
      EQUIVALENCE (RC18(1),HIR(1,1,1))                                  RSTART
C 19                                                                    RSTART
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           RSTART
      DIMENSION RC19(10),IC19(180)                                      RSTART
      EQUIVALENCE (RC19(1),CREST),(IC19(1),JSTOP(1,1,1))                RSTART
C 20                                                                    RSTART
      COMMON/CYDATA/ CYTD(5),CYPA(5),CYSP(5),CYT0(5),CYV0(5),CYCD(5),   RSTART
     *               CYK(5),CYR(5),CYAT(5),CYPV(5),CYCD0(5),CYA0(5),    RSTART
     *               CYP0(5),CYSS(5),CYL0(5),CYC(5),CYRHO0(5),CYVMAX(5),RSTART
     *               CYORFC(5),CYRHO(5),CYT(5),CYP(5),CYV(5)            RSTART
      DIMENSION RC20A(95),RC20B(20)                                     RSTART
      EQUIVALENCE (RC20A(1),CYTD(1)) , (RC20B(1),CYRHO(1))              RSTART
C 21                                                                    RSTART
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 ATBIII
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      DIMENSION RC21(450),IC21(520)                                     TTHKREF
      EQUIVALENCE (RC21(1),XSG(1,1,1)) , (IC21(1),LPMI(1))              RSTART
C 22                                                                    RSTART
      COMMON/FLXBLE/ HF(4,12,8),B42(3,3,24),V4(3,8),NFLEX(3,8)          RSTART
      DIMENSION RC22(624),IC22(24)                                      RSTART
      EQUIVALENCE (RC22(1),HF(1,1,1)) , (IC22(1),NFLEX(1,1))            RSTART
C 23                                                                    RSTART
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       RSTART
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          RSTART
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         RSTART
      DIMENSION RC23(1922),IC23(765)                                    RSTART
      EQUIVALENCE (RC23(1),BAR(1,1)),(IC23(1),IBAR(1,1))                RSTART
C 24                                                                    RSTART
      COMMON/WINDFR/ WTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),    WINDOP
     *               MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)       WINDOP
      DIMENSION RC24(150),IC24(1151)                                    WINDOP
      EQUIVALENCE (RC24(1),WTIME(1)),(IC24(1),IWIND(1))                 RSTART
C                                                                       RSTART
      REAL AOLD4,AAOLD4                                                 RSTART
      DIMENSION COMMON(24),INDEX(3)                                     RSTART
      DATA COMMON /8HCONTRL  ,8HCNTSRF  ,8HVPOSTN  ,8HSGMNTS  ,         RSTART
     *             8HCMATRX  ,8HABDATA  ,8HTITLES  ,8HCNSNTS  ,         RSTART
     *             8HDESCRP  ,8HJBARTZ  ,8HFORCES  ,8HINTEST  ,         RSTART
     *             8HCSTRNT  ,8HTABLES  ,8HCOMAIN  ,8HCDINT   ,         RSTART
     *             8HDAMPER  ,8HCEULER  ,8HTEMPVI  ,8HCYDATA  ,         RSTART
     *             8HRSAVE   ,8HFLXBLE  ,8HHRNESS  ,8HWINDFR  /         RSTART
      DATA BLANK/8H        /                                            RSTART
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      CALL ELTIME(1,25)                                                 RSTART
      GO TO (100,200,300,400,500),IF                                    RSTART
C                                                                       RSTART
C        1. READ INPUT & INITIALIZATION RECORD FROM OLD RESTART TAPE.   RSTART
C                                                                       RSTART
  100 READ  (IT) IC1, PL, RC3, IC3, NSYM, RC6A, IFULL, XDTE, XCMENT,    RSTART
     *           RC7, CGS, JS, RC8, RC9, IC9, IC10, NPANEL, SGTEST,     RSTART
     *           RC13, IC13, IC14, DT, H0, HMAX, HMIN, NSTEPS, NDINT,   RSTART
     *           RC17, IC17, IEULER, IC19, RC20A, RC21, IC21, HF, IC22, RSTART
     *           RC23, IC23, RC24, IC24                                 RSTART
      WRITE (6,101) IT,XDTE,XCMENT                                      RSTART
  101 FORMAT('0 INPUT DATA HAS BEEN READ IN FROM UNIT NO.',I4//         RSTART
     *       10X,3A4//10X,20A4/10X,20A4)                                RSTART
      GO TO 999                                                         RSTART
C                                                                       RSTART
C        2. WRITE INPUT & INITIALIZATION RECORD ONTO NEW RESTART TAPE.  RSTART
C                                                                       RSTART
  200 WRITE (IT) IC1, PL, RC3, IC3, NSYM, RC6A, IFULL, DATE, COMENT,    RSTART
     *           RC7, CGS, JS, RC8, RC9, IC9, IC10, NPANEL, SGTEST,     RSTART
     *           RC13, IC13, IC14, DT, H0, HMAX, HMIN, NSTEPS, NDINT,   RSTART
     *           RC17, IC17, IEULER, IC19, RC20A, RC21, IC21, HF, IC22, RSTART
     *           RC23, IC23, RC24, IC24                                 RSTART
      GO TO 999                                                         RSTART
C                                                                       RSTART
C        3. READ TIME POINT RECORD FROM OLD RESTART TAPE.               RSTART
C                                                                       RSTART
  300 READ  (IT) TIME, BELT, TPTS, BD, RC4, RC5B, RC6B, IFULL, IPIN,    RSTART
     *           RC11, IC11, XTEST, SEGT, REGT, RC13H, KQTYPE, TAB,     RSTART
     *           VAR, DER, NEQ, RC16, IC16, IEULER, RC18, IC19, RC20B,  RSTART
     *           RC21, IC21, V4, RC23, NL, NPTPLY, WTIME, IWIND         RSTART
      CALL OUTPUT(1)                                                    RSTART
      GO TO 999                                                         RSTART
C                                                                       RSTART
C        5. WRITE TIME POINT RECORD ONTO NEW RESTART TAPE.              RSTART
C                                                                       RSTART
  500 WRITE (IT) TIME, BELT, TPTS, BD, RC4, RC5B, RC6B, IFULL, IPIN,    RSTART
     *           RC11, IC11, XTEST, SEGT, REGT, RC13H, KQTYPE, TAB,     RSTART
     *           VAR, DER, NEQ, RC16, IC16, IEULER, RC18, IC19, RC20B,  RSTART
     *           RC21, IC21, V4, RC23, NL, NPTPLY, WTIME, IWIND         RSTART
      GO TO 999                                                         RSTART
C                                                                       RSTART
C        4. READ NEW INPUT DATA FROM INPUT STREAM FOR RESTART.          RSTART
C                                                                       RSTART
  400 READ (5,399) AVAR,INDEX,ITYPE,RR,II,AA,RROLD,IIOLD,AAOLD          RSTART
  399 FORMAT(A8,4I4,2(F8.0,I8,A8))                                      RSTART
      CALL SEARCH(AVAR,INDEX,NCOM,ITEM)                                 RSTART
      IF (NCOM.LE.0)    GO TO 490                                       RSTART
      IF (NCOM.GT.24)   GO TO 999                                       RSTART
      IF (ITYPE.GT.3)   GO TO 490                                       RSTART
      GO TO ( 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12,            RSTART
     *       13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24) , NCOM     RSTART
C     COMMON /CONTRL/                                                   RSTART
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    1 IF (ITEM.GT.1)     GO TO 401                                              RSTART
      IF (ITYPE.NE.1)    GO TO 490                                              RSTART
      ROLD = TIME                                                               RSTART
      TIME = RR                                                                 RSTART
      GO TO 492                                                                 RSTART
  401 IF (ITEM.GT.52)    GO TO 490                                              PAGE
      IF (ITYPE.NE.2)    GO TO 490                                              RSTART
      IOLD = IC1(ITEM-1)                                                        RSTART
      IC1(ITEM-1) = II                                                          RSTART
      GO TO 494                                                                 RSTART
C     COMMON /CNTSRF/                                                           RSTART
    2 IF (ITEM.GT.1888) GO TO 490                                               EDGE
      IF (ITYPE.NE.1)    GO TO 490                                              RSTART
      ROLD = RC2(ITEM)                                                          RSTART
      RC2(ITEM) = RR                                                            RSTART
      GO TO 492                                                                 RSTART
C     COMMON /VPOSTN/                                                           RSTART
    3 IF (ITEM.GT.18084) GO TO 403                                              VEHICL
      IF (ITYPE.NE.1)    GO TO 490                                              RSTART
      ROLD = RC3(ITEM)                                                          RSTART
      RC3(ITEM) = RR                                                            RSTART
      GO TO 492                                                                 RSTART
  403 IF (ITEM.GT.18096) GO TO 490                                              VEHICL
      IF (ITYPE.NE.2)    GO TO 490                                              RSTART
      IOLD = IC3(ITEM-18084)                                                    VEHICL
      IC3(ITEM-18084) = II                                                      VEHICL
      GO TO 494                                                                 RSTART
C     COMMON /SGMNTS/                                                           RSTART
    4 IF (ITEM.GT.900 ) GO TO 404                                               RSTART
      IF (ITYPE.NE.1)    GO TO 490                                              RSTART
      ROLD = RC4(ITEM)                                                          RSTART
      RC4(ITEM) = RR                                                            RSTART
      GO TO 492                                                                 RSTART
  404 IF (ITEM.GT.930 ) GO TO 490                                               RSTART
      IF (ITYPE.NE.2)    GO TO 490                                              RSTART
      IOLD = NSYM(ITEM-900)                                                     RSTART
      NSYM(ITEM-900) = II                                                       RSTART
      GO TO 494                                                                 RSTART
C     COMMON /CMATRX/                                                           RSTART
    5 IF (ITEM.GT.1776) GO TO 490                                               SLIP
      IF (ITYPE.NE.1)    GO TO 490                                              RSTART
      ROLD = RC5A(ITEM)                                                         RSTART
      RC5A(ITEM) = RR                                                           RSTART
      GO TO 492                                                                 RSTART
C     COMMON /ABDATA/                                                           RSTART
    6 IF (ITEM.GT.881 ) GO TO 406                                               RSTART
      IF (ITYPE.NE.1)    GO TO 490                                              RSTART
      ROLD = RC6A(ITEM)                                                         RSTART
      RC6A(ITEM) = RR                                                           RSTART
      GO TO 492                                                                 RSTART
  406 IF (ITEM.GT.887 ) GO TO 490                                               RSTART
      IF (ITYPE.NE.2)    GO TO 490                                              RSTART
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      IOLD = IFULL(ITEM-881)                                            RSTART
      IFULL(ITEM-881) = II                                              RSTART
      GO TO 494                                                         RSTART
C     COMMON /TITLES/ NOTE: NO PROVISION FOR CGS OR JS.                 RSTART
    7 IF (ITEM.GT.348 ) GO TO 490                                       RSTART
      IF (ITYPE.NE.3)   GO TO 490                                       RSTART
      AOLD = RC7A(ITEM)                                                 RSTART
      RC7A(ITEM) = AA                                                   RSTART
      GO TO 496                                                         RSTART
C     COMMON /CNSNTS/                                                   RSTART
    8 IF (ITEM.GT.35  ) GO TO 490                                       TWOPI
      IF (ITEM.GT.31  ) GO TO 408                                       RSTART
      IF (ITEM.LE.28  ) GO TO 408                                       RSTART
      IF (ITYPE.NE.3)   GO TO 490                                       RSTART
      AOLD = RC8(ITEM)                                                  RSTART
      RC8(ITEM) = AA                                                    RSTART
      GO TO 496                                                         RSTART
  408 IF (ITYPE.NE.1)   GO TO 490                                       RSTART
      ROLD = RC8(ITEM)                                                  RSTART
      RC8(ITEM) = RR                                                    RSTART
      GO TO 492                                                         RSTART
C     COMMON /DESCRP/                                                   RSTART
    9 IF (ITEM.GT.2460) GO TO 409                                       SLIP
      IF (ITYPE.NE.1)   GO TO 490                                       RSTART
      ROLD = RC9(ITEM)                                                  RSTART
      RC9(ITEM) = RR                                                    RSTART
      GO TO 492                                                         RSTART
  409 IF (ITEM.GT.2610) GO TO 490                                       SLIP
      IF (ITYPE.NE.2)   GO TO 490                                       RSTART
      IOLD = IC9(ITEM-2460)                                             SLIP
      IC9(ITEM-2460) = II                                               SLIPRT
      GO TO 494                                                         RSTART
C     COMMON /JBARTZ/                                                   RSTART
   10 IF (ITEM.GT.1614) GO TO 490                                       RSTART
      IF (ITYPE.NE.2)   GO TO 490                                       RSTART
      IOLD = IC10(ITEM)                                                 RSTART
      IC10(ITEM) = II                                                   RSTART
      GO TO 494                                                         RSTART
C     COMMON /FORCES/                                                   RSTART
   11 IF (ITEM.GT.1240) GO TO 411                                       NCFORC
      IF (ITYPE.NE.1)   GO TO 490                                       RSTART
      ROLD = RC11(ITEM)                                                 RSTART
      RC11(ITEM) = RR                                                   RSTART
      GO TO 492                                                         RSTART
  411 IF (ITEM.GT.1249) GO TO 490                                       NCFORC
      IF (ITYPE.NE.2)   GO TO 490                                       RSTART
      IOLD = IC11(ITEM-1240)                                            NCFORC
      IC11(ITEM-1240) = II                                              NCFORC
      GO TO 494                                                         RSTART
C     COMMON /INTEST/                                                   RSTART
   12 IF (ITEM.GT.720 ) GO TO 412                                       RSTART
      IF (ITYPE.NE.1)   GO TO 490                                       RSTART
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      ROLD = RC12(ITEM)                                          RSTART
      RC12(ITEM) = RR                                            RSTART
      GO TO 492                                                  RSTART
  412 IF (ITEM.GT.840 ) GO TO 512                                RSTART
      IF (ITYPE.NE.3)   GO TO 490                                RSTART
      AOLD = SEGT(ITEM-720)                                      RSTART
      SEGT(ITEM-720) = AA                                        RSTART
      GO TO 496                                                  RSTART
  512 IF (ITEM.GT.960 ) GO TO 490                                RSTART
      IF (ITYPE.NE.3)   GO TO 490                                RSTART
      AOLD = REGT(ITEM-840)                                      RSTART
      REGT(ITEM-840) = AA                                        RSTART
      GO TO 496                                                  RSTART
C     COMMON /CSTRNT/                                            RSTART
   13 IF (ITEM.GT.1212) GO TO 413                                RSTART
      IF (ITYPE.NE.1)   GO TO 490                                RSTART
      ROLD = RC13A(ITEM)                                         RSTART
      RC13A(ITEM) = RR                                           RSTART
      GO TO 492                                                  RSTART
  413 IF (ITEM.GT.1248) GO TO 490                                RSTART
      IF (ITYPE.NE.2)   GO TO 490                                RSTART
      IOLD = IC13(ITEM-1212)                                     RSTART
      IC13(ITEM-1212) = II                                       RSTART
      GO TO 494                                                  RSTART
C     COMMON /TABLES/                                            RSTART
   14 IF (ITEM.GT.1304 ) GO TO 414                               RSTART
      IF (ITYPE.NE.2)   GO TO 490                                BUTLER2
      IOLD = IC14(ITEM)                                          RSTART
      IC14(ITEM) = II                                            RSTART
      GO TO 494                                                  RSTART
  414 IF (ITEM.GT.5804) GO TO 490                                RSTART
      IF (ITYPE.NE.1)   GO TO 490                                MISC
      ROLD = TAB(ITEM-1304)                                      RSTART
      TAB(ITEM-1304) = RR                                        BUTLER2
      GO TO 492                                                  BUTLER2
C     COMMON /COMAIN/                                            RSTART
   15 IF (ITEM.GT.485 ) GO TO 415                                RSTART
      IF (ITYPE.NE.1)   GO TO 490                                RSTART
      ROLD = RC15(ITEM)                                          RSTART
      RC15(ITEM) = RR                                            RSTART
      GO TO 492                                                  RSTART
  415 IF (ITEM.GT.491 ) GO TO 490                                RSTART
      IF (ITYPE.NE.2)   GO TO 490                                RSTART
      IOLD = IC15(ITEM-485)                                      RSTART
      IC15(ITEM-485) = II                                        RSTART
      GO TO 494                                                  RSTART
C     COMMON /CDINT /                                            RSTART
   16 IF (ITEM.GT.5541) GO TO 416                                RSTART
      IF (ITYPE.NE.1)   GO TO 490                                RSTART
      ROLD = RC16(ITEM)                                          RSTART
      RC16(ITEM) = RR                                            RSTART
      GO TO 492                                                  RSTART
                                                                 RSTART
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  416 IF (ITEM.GT.5544) GO TO 490                                     RSTART
      IF (ITYPE.NE.2)   GO TO 490                                     RSTART
      IOLD = IC16(ITEM-5541)                                          RSTART
      IC16(ITEM-5541) = II                                            RSTART
      GO TO 494                                                       RSTART
C     COMMON /DAMPER/                                                 RSTART
   17 IF (ITEM.GT.220 ) GO TO 417                                     RSTART
      IF (ITYPE.NE.1)   GO TO 490                                     RSTART
      ROLD = RC17(ITEM)                                               RSTART
      RC17(ITEM) = RR                                                 RSTART
      GO TO 492                                                       RSTART
  417 IF (ITEM.GT.260 ) GO TO 490                                     RSTART
      IF (ITYPE.NE.2)   GO TO 490                                     RSTART
      IOLD = IC17(ITEM-220)                                           RSTART
      IC17(ITEM-220) = II                                             RSTART
      GO TO 494                                                       RSTART
C     COMMON /CEULER/                                                 RSTART
   18 IF (ITEM.GT.30  ) GO TO 418                                     RSTART
      IF (ITYPE.NE.2)   GO TO 490                                     RSTART
      IOLD = IEULER(ITEM)                                             RSTART
      IEULER(ITEM) = II                                               RSTART
      GO TO 494                                                       RSTART
  418 IF (ITEM.GT.1350) GO TO 490                                     JDRIFT
      IF (ITYPE.NE.1)   GO TO 490                                     RSTART
      ROLD = RC18(ITEM-30)                                            RSTART
      RC18(ITEM-30) = RR                                              RSTART
      GO TO 492                                                       RSTART
C     COMMON /TEMPVI/                                                 RSTART
   19 IF (ITEM.GT.10  ) GO TO 419                                     RSTART
      IF (ITYPE.NE.1)   GO TO 490                                     RSTART
      ROLD = RC19(ITEM)                                               RSTART
      RC19(ITEM) = RR                                                 RSTART
      GO TO 492                                                       RSTART
  419 IF (ITEM.GT.190 ) GO TO 490                                     RSTART
      IF (ITYPE.NE.2)   GO TO 490                                     RSTART
      IOLD = IC19(ITEM-10)                                            RSTART
      IC19(ITEM-10) = II                                              RSTART
      GO TO 494                                                       RSTART
C     COMMON/CYDATA/                                                  RSTART
   20 IF (ITEM.GT.115 ) GO TO 490                                     RSTART
      IF (ITYPE.NE.1)   GO TO 490                                     RSTART
      ROLD = RC20A(ITEM)                                              RSTART
      RC20A(ITEM) = RR                                                RSTART
      GO TO 492                                                       RSTART
C     COMMON /RSAVE/                                                  RSTART
   21 IF (ITEM.GT.450 ) GO TO 421                                     RSTART
      IF (ITYPE.NE.1  ) GO TO 490                                     RSTART
      ROLD = RC21(ITEM)                                               RSTART
      RC21(ITEM) = RR                                                 RSTART
      GO TO 492                                                       RSTART
  421 IF (ITEM.GT.970 ) GO TO 490                                     TTHKREF
      IF (ITYPE.NE.2  ) GO TO 490                                     RSTART
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      IOLD = IC21(ITEM-450)                                              RSTART
      IC21(ITEM-450) = II                                                RSTART
      GO TO 494                                                          RSTART
C     COMMON /FLXBLE/                                                    RSTART
   22 IF (ITEM.GT.624 ) GO TO 422                                        RSTART
      IF (ITYPE.NE.1  ) GO TO 490                                        RSTART
      ROLD = RC22(ITEM)                                                  RSTART
      RC22(ITEM) = RR                                                    RSTART
      GO TO 492                                                          RSTART
  422 IF (ITEM.GT.648 ) GO TO 490                                        RSTART
      IF (ITYPE.NE.2  ) GO TO 490                                        RSTART
      IOLD = IC22(ITEM-624)                                              RSTART
      IC22(ITEM-624) = II                                                RSTART
      GO TO 494                                                          RSTART
C     COMMON /HRNESS/                                                    RSTART
   23 IF (ITEM.GT.1922) GO TO 423                                        RSTART
      IF (ITYPE.NE.1)   GO TO 490                                        RSTART
      ROLD = RC23(ITEM)                                                  RSTART
      RC23(ITEM) = RR                                                    RSTART
      GO TO 492                                                          RSTART
  423 IF (ITEM.GT.2687) GO TO 490                                        RSTART
      IF (ITYPE.NE.2)   GO TO 490                                        RSTART
      IOLD = IC23(ITEM-1922)                                             RSTART
      IC23(ITEM-1922) = II                                               RSTART
      GO TO 494                                                          RSTART
C     COMMON /WINDFR/                                                    RSTART
   24 IF (ITEM.GT.150 ) GO TO 424                                        WINDOP
      IF (ITYPE.NE.1)   GO TO 490                                        RSTART
      ROLD = RC24(ITEM)                                                  RSTART
      RC24(ITEM) = RR                                                    RSTART
      GO TO 492                                                          RSTART
  424 IF (ITEM.GT.1301) GO TO 490                                        WINDOP
      IF (ITYPE.NE.2)   GO TO 490                                        RSTART
      IOLD = IC24(ITEM-150)                                              WINDOP
      IC24(ITEM-150)= II                                                 WINDOP
      GO TO 494                                                          RSTART
C                                                                        RSTART
C     ERROR MESSAGE - TERMINATE PROGRAM.                                 RSTART
C                                                                        RSTART
  490 WRITE (6,491) AVAR,INDEX,NCOM,ITEM,ITYPE,RR,II,AA                  RSTART
  491 FORMAT('0 SUBROUTINE RSTART INPUT ERROR'//                         RSTART
     *       ' AVAR= ',A8,'INDEX=',3I6,' NCOM=',I6,' ITEM=',I6,          RSTART
     * ' ITYPE=',I6,' RR=',G15.8,' II=',I8,' AA= ',A8//                  RSTART
     * ' PROGRAM IS BEING TERMINATED.')                                  RSTART
      STOP 2                                                             RSTART
C                                                                        RSTART
C     PRINT MESSAGE FOR REAL VARIABLES.                                  RSTART
C                                                                        RSTART
  492 WRITE (6,493) AVAR,INDEX,COMMON(NCOM),ROLD,RR                      RSTART
  493 FORMAT('0',A6,'(',I4,',',I4,',',I4,') OF COMMON/',A6,'/',          RSTART
     *       ' HAS BEEN CHANGED FROM ',G15.8,' TO ',G15.8)               RSTART
      IF (RROLD.EQ.0.0) GO TO 400                                        RSTART
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      IF (DABS(RROLD-ROLD).LE.0.00001*RROLD) GO TO 400                  RSTART
      WRITE (6,383) RROLD                                               RSTART
  383 FORMAT(' INPUT VALUE FOR RROLD WAS ',G15.8//)                     RSTART
      GO TO 490                                                         RSTART
C                                                                       RSTART
C     PRINT MESSAGE FOR INTEGER VARIABLES.                              RSTART
C                                                                       RSTART
  494 WRITE (6,495) AVAR,INDEX,COMMON(NCOM),IOLD,II                     RSTART
  495 FORMAT('0',A6,'(',I4,',',I4,',',I4,') OF COMMON/',A6,'/',         RSTART
     *       ' HAS BEEN CHANGED FROM ',   I8,' TO ',   I8)              RSTART
      IF (IIOLD.EQ.0) GO TO 400                                         RSTART
      IF (IOLD.EQ.IIOLD) GO TO 400                                      RSTART
      WRITE (6,385) IIOLD                                               RSTART
  385 FORMAT(' INPUT VALUE FOR IIOLD WAS ',I8//)                        RSTART
      GO TO 490                                                         RSTART
C                                                                       RSTART
C     PRINT MESSAGE FOR ALPHANUMERIC VARIABLES.                         RSTART
C                                                                       RSTART
  496 WRITE (6,497) AVAR,INDEX,COMMON(NCOM),AOLD,AA                     RSTART
  497 FORMAT('0',A6,'(',I4,',',I4,',',I4,') OF COMMON/',A6,'/',         RSTART
     *       ' HAS BEEN CHANGED FROM ',   A8,' TO ',   A8)              RSTART
      IF (AAOLD.EQ.BLANK) GO TO 400                                     RSTART
      AAOLD4 = AAOLD                                                    RSTART
      AOLD4  = AOLD                                                     RSTART
      IF (AOLD4.EQ.AAOLD4) GO TO 400                                    RSTART
      WRITE (6,387) AAOLD                                               RSTART
  387 FORMAT(' INPUT VALUE FOR AAOLD WAS ',A8//)                        RSTART
      GO TO 490                                                         RSTART
  999 CALL ELTIME(2,25)                                                 RSTART
      RETURN                                                            RSTART
      END                                                               RSTART
```

```
      SUBROUTINE SEARCH(AVAR,INDEX,NCOM,ITEM)                           SEARCH
C                                                  REV IV    07/24/86SLIP
C     CALLED BY SUBROUTINE RSTART TO COMPUTE NCOM & ITEM FROM AVAR &    SEARCH
C     INDEX. RETURNS NCOM=0 FOR ERROR AND NCOM=50 FOR BLANK.            SEARCH
C                                                                       SEARCH
      IMPLICIT REAL*8(A-H,O-Z)                                          SEARCH
      DIMENSION BVAR(264),KOUNT(25),NDIM(3,264),NJ(3),NK(3),INDEX(3)    SLIP
      DIMENSION C1 (  17) , NC1 (  51)                                  PAGE
      DIMENSION C2 (   4) , NC2 (  12)                                  SEARCH
      DIMENSION C3 (  10) , NC3 (  30)                                  SEARCH
      DIMENSION C4 (   9) , NC4 (  27)                                  SEARCH
      DIMENSION C5 (   9) , NC5 (  27)                                  SLIP
      DIMENSION C6 (  30) , NC6 (  90)                                  SEARCH
      DIMENSION C7 (  11) , NC7 (  33)                                  SEARCH
      DIMENSION C8 (  10) , NC8 (  30)                                  TWOPI
      DIMENSION C9 (  15) , NC9 (  45)                                  SEARCH
      DIMENSION C10(  11) , NC10(  33)                                  SEARCH
      DIMENSION C11(  10) , NC11(  30)                                  SEARCH
      DIMENSION C12(   4) , NC12(  12)                                  SEARCH
      DIMENSION C13(  16) , NC13(  48)                                  SEARCH
      DIMENSION C14(   7) , NC14(  21)                                  SEARCH
      DIMENSION C15(  13) , NC15(  39)                                  SEARCH
      DIMENSION C16(  15) , NC16(  45)                                  SEARCH
      DIMENSION C17(   5) , NC17(  15)                                  SEARCH
      DIMENSION C18(   7) , NC18(  21)                                  SEARCH
      DIMENSION C19(   5) , NC19(  15)                                  SEARCH
      DIMENSION C20(  23) , NC20(  69)                                  SEARCH
      DIMENSION C21(   8) , NC21(  24)                                  CHGIII
      DIMENSION C22(   4) , NC22(  12)                                  SEARCH
      DIMENSION C23(  12) , NC23(  36)                                  SEARCH
      DIMENSION C24(   9) , NC24(  27)                                  WINDOP
C                                                                       SEARCH
      EQUIVALENCE (C1 (1),BVAR(  1)) , (NC1 (1),NDIM(1,  1))            SEARCH
      EQUIVALENCE (C2 (1),BVAR( 18)) , (NC2 (1),NDIM(1, 18))            PAGE
      EQUIVALENCE (C3 (1),BVAR( 22)) , (NC3 (1),NDIM(1, 22))            PAGE
      EQUIVALENCE (C4 (1),BVAR( 32)) , (NC4 (1),NDIM(1, 32))            PAGE
      EQUIVALENCE (C5 (1),BVAR( 41)) , (NC5 (1),NDIM(1, 41))            PAGE
      EQUIVALENCE (C6 (1),BVAR( 50)) , (NC6 (1),NDIM(1, 50))            SLIP
      EQUIVALENCE (C7 (1),BVAR( 80)) , (NC7 (1),NDIM(1, 80))            SLIP
      EQUIVALENCE (C8 (1),BVAR( 91)) , (NC8 (1),NDIM(1, 91))            SLIP
      EQUIVALENCE (C9 (1),BVAR(101)) , (NC9 (1),NDIM(1,101))            SLIP
      EQUIVALENCE (C10(1),BVAR(116)) , (NC10(1),NDIM(1,116))            SLIP
      EQUIVALENCE (C11(1),BVAR(127)) , (NC11(1),NDIM(1,127))            SLIP
      EQUIVALENCE (C12(1),BVAR(137)) , (NC12(1),NDIM(1,137))            SLIP
      EQUIVALENCE (C13(1),BVAR(141)) , (NC13(1),NDIM(1,141))            SLIP
      EQUIVALENCE (C14(1),BVAR(157)) , (NC14(1),NDIM(1,157))            SLIP
      EQUIVALENCE (C15(1),BVAR(164)) , (NC15(1),NDIM(1,164))            SLIP
      EQUIVALENCE (C16(1),BVAR(177)) , (NC16(1),NDIM(1,177))            SLIP
      EQUIVALENCE (C17(1),BVAR(192)) , (NC17(1),NDIM(1,192))            SLIP
      EQUIVALENCE (C18(1),BVAR(197)) , (NC18(1),NDIM(1,197))            SLIP
      EQUIVALENCE (C19(1),BVAR(204)) , (NC19(1),NDIM(1,204))            SLIP
      EQUIVALENCE (C20(1),BVAR(209)) , (NC20(1),NDIM(1,209))            SLIP
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      EQUIVALENCE (C21(1),BVAR(232)) , (NC21(1),NDIM(1,232))           SLIP
      EQUIVALENCE (C22(1),BVAR(240)) , (NC22(1),NDIM(1,240))           SLIP
      EQUIVALENCE (C23(1),BVAR(244)) , (NC23(1),NDIM(1,244))           SLIP
      EQUIVALENCE (C24(1),BVAR(256)) , (NC24(1),NDIM(1,256))           SLIP
C                                                                      SEARCH
      DATA  NVAR/264/ , KOM/24/ , BLANK/8H        /                    SLIP
      DATA KOUNT/1,18,22,32,41,50,80,91,101,116,127,137,141,157,       SLIP
     *           164,177,192,197,204,209,232,240,244,256,265/          SLIP
C                                                                      SEARCH
C  1  COMMON/CONTRL/                                                   SEARCH
C                                                                      SEARCH
      DATA C1 / 8HTIME    ,8HNSEG    ,8HNJNT    ,8HNPL     ,8HNBLT    , SEARCH
     *          8HNBAG    ,8HNVEH    ,8HNGRND   ,8HNS      ,8HNQ      , SEARCH
     *          8HNSD     ,8HNFLX    ,8HNNRNSS  ,8HNWINDF  ,8HNJNTF   , SEARCH
     *          8HNPRT    ,8HNPG     /                                 PAGE
      DATA NC1 /  0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   , SEARCH
     *            0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   , SEARCH
     *            0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   , SEARCH
     *            36,0,0  ,  0,0,0   /                                 PAGE
C                                                                      SEARCH
C  2  COMMON/CNTSRF/                                                   SEARCH
C                                                                      SEARCH
      DATA C2 / 8HPL      ,8HBELT    ,8HTPTS    ,8HBD      /           SEARCH
      DATA NC2 /  24,30,0 ,  20,8,0  ,  6,8,0   ,  24,40,0 /           EDGE
C                                                                      SEARCH
C  3  COMMON/VPOSTN/                                                   SEARCH
C                                                                      SEARCH
      DATA C3 / 8HZPLT    ,8HSPLT    ,8HAXV     ,8HVATAB   ,8HVTO     , SEARCH
     *          8HVDT     ,8HTIMEV   ,8HOMEGV   ,8HNVTAB   ,8HINDXV   / SEARCH
      DATA NC3 /  3,0,0   ,  3,0,0   ,  3,6,0   ,  6,501,6 ,  6,0,0   , VEHICL
     *            6,0,0   ,  6,0,0   ,  6,0,0   ,  6,0,0   ,  6,0,0   / SEARCH
C                                                                      SEARCH
C  4  COMMON/SGMNTS/                                                   SEARCH
C                                                                      SEARCH
      DATA C4 / 8HD       ,8HWMEG    ,8HWMEGD   ,8HU1      ,8HU2      , SEARCH
     *          8HSEGLP   ,8HSEGLV   ,8HSEGLA   ,8HNSYM    /           SEARCH
      DATA NC4 /  3,3,30  ,  3,30,0  ,  3,30,0  ,  3,30,0  ,  3,30,0  , SEARCH
     *            3,30,0  ,  3,30,0  ,  3,30,0  ,  30,0,0  /           SEARCH
C                                                                      SEARCH
C  5  COMMON/CMATRX/                                                   SEARCH
C                                                                      SEARCH
      DATA C5 / 8HV1      ,8HV2      ,8HV3      ,8HB12     ,8HA22     , SEARCH
     *          8HF       ,8HTQ      ,8HWJ      ,8HA11     /           SLIP
      DATA NC5 /  3,30,0  ,  3,30,0  ,  3,12,0  ,  3,3,60  ,  3,3,60  , SEARCH
     *            3,30,0  ,  3,30,0  ,  30,0,0  ,  3,3,60  /           SLIP
C                                                                      SEARCH
C  6  COMMON/ABDATA/                                                   SEARCH
C                                                                      SEARCH
      DATA C6 / 8HZDEP    ,8HDBR     ,8HDPVCTR  ,8HDEPLOY  ,8HAB      , SEARCH
     *          8HB       ,8HZR      ,8HBFB     ,8HDRR     ,8HVBAGG   , SEARCH
     *          8HVSCS    ,8HSPRK    ,8HCK      ,8HCMASS   ,8HCYMIN   , SEARCH
     *          8HCYMOUT  ,8HBAGPV   ,8HPD      ,8HVBAG    ,8HVOLBP   , SEARCH
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     *           8HPCYV    ,8HPCYMIN  ,8HPVBAG   ,8HTV1     ,8HTV2     , SEARCH
     *           8HSWITCH  ,8HPYMOUT  ,8HSCALE   ,8HPREVT   ,8HIFULL   / SEARCH
      DATA NC6 /  3,5,0    ,  3,3,5   ,  3,5,0   ,  3,5,0   ,  3,5,0   , SEARCH
     *            9,4,5    ,  3,4,5   ,  3,4,5   ,  9,4,5   ,  5,0,0   , SEARCH
     *            5,0,0    ,  5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   , SEARCH
     *            5,0,0    ,  5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   , SEARCH
     *            5,0,0    ,  5,0,0   ,  5,0,0   ,  3,4,5   ,  3,10,5  , SEARCH
     *            5,0,0    ,  5,0,0   ,  5,0,0   ,  0,0,0   ,  6,0,0   / SEARCH
C                                                                        SEARCH
C  7  COMMON/TITLES/                                                     SEARCH
C                                                                        SEARCH
      DATA C7 / 8HDATE     ,8HCOMENT  ,8HVPSTTL  ,8HBDYTTL  ,8HBLTTTL  , SEARCH
     *           8HPLTTL   ,8HBAGTTL  ,8HSEG     ,8HJOINT   ,8HCGS     , SEARCH
     *           8HJS      /                                             SEARCH
      DATA NC7 /  3,0,0    ,  40,0,0  ,  20,0,0  ,  5,0,0   ,  5,8,0   , SEARCH
     *            5,30,0   ,  5,6,0   ,  30,0,0  ,  30,0,0  ,  30,0,0  , SEARCH
     *            30,0,0   /                                             SEARCH
C                                                                        SEARCH
C  8  COMMON/CNSNTS/                                                     SEARCH
C                                                                        SEARCH
      DATA C8 / 8HPI       ,8HRADIAN  ,8HG       ,8HTHIRD   ,8HEPS     , SEARCH
     *           8HUNITL   ,8HUNITM   ,8HUNITT   ,8HGRAVTY  ,8HTWOPI   / TWOPI
      DATA NC8 /  0,0,0    ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  24,0,0  , SEARCH
     *            0,0,0    ,  0,0,0   ,  0,0,0   ,  3,0,0   ,   0,0,0  / TWOPI
C                                                                        SEARCH
C  9  COMMON/DESCRP/                                                     SEARCH
C                                                                        SEARCH
      DATA C9 / 8HPHI      ,8HW       ,8HRW      ,8HSR      ,8HHA      , SEARCH
     *           8HHB      ,8HRPHI    ,8HHT      ,8HSPRING  ,8HVISC    , SEARCH
     *           8HJNT     ,8HJPIN    ,8HJSING   ,8HJGLOB   ,8HJOINTF  / SEARCH
      DATA NC9 /  3,30,0   ,  30,0,0  ,  30,0,0  ,  4,60,0  ,  3,60,0  , SLIP
     *            3,60,0   ,  3,30,0  ,  3,3,60  ,  5,90,0  ,  7,90,0  , SEARCH
     *            30,0,0   ,  30,0,0  ,  30,0,0  ,  30,0,0  ,  30,0,0  / SEARCH
C                                                                        SEARCH
C 10  COMMON/JBARTZ/                                                     SEARCH
C                                                                        SEARCH
      DATA C10/ 8HMNPL     ,8HMNBLT   ,8HMNSEG   ,8HMNBAG   ,8HMPL     , SEARCH
     *           8HMBLT    ,8HMSEG    ,8HMBAG    ,8HNTPL    ,8HNTBLT   , SEARCH
     *           8HNTSEG   /                                             SEARCH
      DATA NC10/  30,0,0   ,  8,0,0   ,  30,0,0  ,  6,0,0   ,  3,5,30  , SEARCH
     *            3,5,8    ,  3,5,30  ,  3,10,6  ,  5,30,0  ,  5,8,0   , SEARCH
     *            5,30,0   /                                             SEARCH
C                                                                        SEARCH
C 11  COMMON/FORCES/                                                     SEARCH
C                                                                        SEARCH
      DATA C11/ 8HPSF      ,8HBSF     ,8HSSF     ,8HBAGSF   ,8HPRJNT   , SEARCH
     *           8HNPANEL  ,8HNPSF    ,8HNBSF    ,8HNSSF    ,8HNBGSF   / SEARCH
      DATA NC11/ 7,70,0    ,  4,20,0  ,  10,40,0 ,  3,20,0  ,  7,30,0  , NCFORC
     *            5,0,0    ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   / SEARCH
C                                                                        SEARCH
C 12  COMMON/INTEST/                                                     SEARCH
C                                                                        SEARCH
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      DATA C12/ 8HSGTEST   ,8HXTEST   ,8HSEGT    ,8HREGT    /           SEARCH
      DATA NC12/  3,4,30   ,  3,120,0 ,  120,0,0 ,  120,0,0 /           SEARCH
C                                                                       SEARCH
C 13  COMMON/CSTRNT/                                                    SEARCH
C                                                                       SEARCH
      DATA C13/ 8HA13      ,8HA23     ,8HB31     ,8HB32     ,8HHHT     , SEARCH
     *          8HRK1      ,8HRK2     ,8HQQ      ,8HTQQ     ,8HRQQ     , SEARCH
     *          8HHQQ      ,8HSQQ     ,8HCFQQ    ,8HKQ1     ,8HKQ2     , SEARCH
     *          8HKQTYPE   /                                            SEARCH
      DATA NC13/  3,3,24   ,  3,3,24  ,  3,3,24  ,  3,3,24  ,  3,3,12  , SEARCH
     *            3,12,0   ,  3,12,0  ,  3,12,0  ,  3,12,0  ,  3,12,0  , SEARCH
     *            3,12,0   ,  12,0,0  ,  12,0,0  ,  12,0,0  ,  12,0,0  , SEARCH
     *            12,0,0   /                                            SEARCH
C                                                                       SEARCH
C 14  COMMON/TABLES/                                                    SEARCH
C                                                                       SEARCH
      DATA C14/ 8HMXNTI    ,8HMXNTB   ,8HMXTB1   ,8HMXTB2   ,8HNTI     , SEARCH
     *          8HNTAB     ,8HTAB     /                                 SEARCH
      DATA NC14/  0,0,0    ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  50,0,0  , SEARCH
     *          1250,0,0   , 4500,0,0/                                  BUTLER2
C                                                                       SEARCH
C 15  COMMON/COMAIN/                                                    SEARCH
C                                                                       SEARCH
      DATA C15/ 8HVAR      ,8HDER     ,8HDT      ,8HHO      ,8HHMAX    , SEARCH
     *          8HHMIN     ,8HRSTIME  ,8HISTEP   ,8HNSTEPS  ,8HNDINT   , SEARCH
     *          8HNEQ      ,8HIRSIN   ,8HIRSOUT  /                      SEARCH
      DATA NC15/ 240,0,0   , 240,0,0  ,  0,0,0   ,  0,0,0   ,  0,0,0   , SEARCH
     *           0,0,0     ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   , SEARCH
     *           0,0,0     ,  0,0,0   ,  0,0,0   /                      SEARCH
C                                                                       SEARCH
C 16  COMMON/CDINT /                                                    SEARCH
C                                                                       SEARCH
      DATA C16/ 8HUU       ,8HGH      ,8HE       ,8HFF      ,8HGG      , SEARCH
     *          8HY        ,8HU       ,8HH       ,8HHPRINT  ,8HHS      , SEARCH
     *          8HTPRINT   ,8HTSTART  ,8HICNT    ,8HIDBL    ,8HIFLAG   / SEARCH
      DATA NC16/  4,0,0    ,  3,4,0   ,  3,240,0 ,  5,240,0 ,  5,240,0 , SEARCH
     *            5,240,0  ,  5,240,0 ,  0,0,0   ,  0,0,0   ,  0,0,0   , SEARCH
     *            0,0,0    ,  0,0,0   ,  0,0,0   ,  0,0,0   ,  0,0,0   / SEARCH
C                                                                       SEARCH
C 17  COMMON/DAMPER/                                                    SEARCH
C                                                                       SEARCH
      DATA C17/ 8HAPSDM    ,8HAPSDN   ,8HASD     ,8HMSDM    ,8HMSDN    / SEARCH
      DATA NC17/  3,20,0   ,  3,20,0  ,  5,20,0  ,  20,0,0  ,  20,0,0  / SEARCH
C                                                                       SEARCH
C 18  COMMON/CEULER/                                                    SEARCH
C                                                                       SEARCH
      DATA C18/ 8HIEULER   ,8HHIR     ,8HANG     ,8HANGD    ,8HFE      , SEARCH
     *          8HTQE      ,8HCONST   /                                 SEARCH
      DATA NC18/  30,0,0   ,  3,3,90  ,  3,30,0  ,  3,30,0  ,  3,30,0  , JDRIFT
     *            3,30,0   ,  5,30,0  /                                 JDRIFT
C                                                                       SEARCH
C 19  COMMON/TEMPVI/                                                    SEARCH
                                                                        SEARCH
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C                                                                        SEARCH
      DATA C19/ 8HCREST   ,8HTTI     ,8HR1I     ,8HR2I     ,8HJSTOP   / SEARCH
      DATA NC19/  0,0,0   ,  3,0,0   ,  3,0,0   ,  3,0,0   ,  4,2,30  / SEARCH
C                                                                        SEARCH
C 20  COMMON/CYDATA/                                                     SEARCH
C                                                                        SEARCH
      DATA C20/ 8HCYTD    ,8HCYPA    ,8HCYSP    ,8HCYTO    ,8HCYVO    , SEARCH
     *          8HCYCD    ,8HCYK     ,8HCYR     ,8HCYAT    ,8HCYPV    , SEARCH
     *          8HCYCDO   ,8HCYAO    ,8HCYPO    ,8HCYSS    ,8HCYLO    , SEARCH
     *          8HCYC     ,8HCYRHOO  ,8HCYVMAX  ,8HCYORFC  ,8HCYRHO   , SEARCH
     *          8HCYT     ,8HCYRHP   ,8HCYV     /                       SEARCH
      DATA NC20/  5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   , SEARCH
     *            5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   , SEARCH
     *            5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   , SEARCH
     *            5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   ,  5,0,0   , SEARCH
     *            5,0,0   ,  5,0,0   ,  5,0,0   /                       SEARCH
C                                                                        SEARCH
C 21  COMMON/RSAVE/                                                      SEARCH
C                                                                        SEARCH
      DATA C21/ 8HXSG     ,8HDPMI    ,8HLPMI    ,8HNSG     ,8HMSG     , SEARCH
     *          8HMCG     ,8HMCGIN   ,8HKREF    /                       CHGIII
      DATA NC21/  3,20,3  ,  3,3,30  ,  30,0,0  ,  9,0,0   ,  20,9,0  , WINDOP
     *            1,0,0   ,  24,5,0  ,  20,9,0  /                       TTHKREF
C                                                                        SEARCH
C 22  COMMON/FLXBLE/                                                     SEARCH
C                                                                        SEARCH
      DATA C22/ 8HHF      ,8HB42     ,8HV4      ,8HNFLEX   /            SEARCH
      DATA NC22/  4,12,8  ,  3,3,24  ,  3,8,0   ,  3,8,0   /            SEARCH
C                                                                        SEARCH
C 23  COMMON/HRNESS/                                                     SEARCH
C                                                                        SEARCH
      DATA C23/ 8HBAR     ,8HBB      ,8HBBDOT   ,8HPLOSS   ,8HXLONG   , SEARCH
     *          8HHTIME   ,8HIBAR    ,8HNL      ,8HNPTSPB  ,8HNPTPLY  , SEARCH
     *          8HNTHRNS  ,8HNBLTPH  /                                  SEARCH
      DATA NC23/ 15,100,0,  100,0,0  ,  100,0,0 ,  2,100,0 ,  20,0,0  , SEARCH
     *            2,0,0   ,  5,100,0 ,  2,100,0 ,  20,0,0  ,  20,0,0  , SEARCH
     *            20,0,0  ,  5,0,0   /                                  SEARCH
C                                                                        SEARCH
C 24  COMMON/WINDFR/                                                     SEARCH
      DATA C24/ 8HWTIME   ,8HQFU     ,8HQFV     ,8HWF      ,8HIWIND   , WINDOP
     *          8HMWSEG   ,8HNFVSEG  ,8HNFVNT   ,8HMOWSEG  /            WINDOP
      DATA NC24/ 30,0,0   ,  3, 5,0  ,  3, 5,0  ,  3,30,0  ,  30,0,0  , WINDOP
     *           7,30,0   ,  6,0,0   ,  5,0,0   ,  30,30,0 /            WINDOP
      NCOM = 50                                                          SEARCH
      IF (AVAR.EQ.BLANK) GO TO 99                                        SEARCH
C                                                                        SEARCH
C     SEARCH FOR VARIABLE NO. IV.                                        SEARCH
C                                                                        SEARCH
      NCOM = 0                                                           SEARCH
      DO 10 IV=1,NVAR                                                    SEARCH
      IF (AVAR.EQ.BVAR(IV)) GO TO 12                                     SEARCH
   10 CONTINUE                                                           SEARCH
                                                                         SEARCH
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      GO TO 99                                                  SEARCH
C                                                               SEARCH
C     SEARCH FOR COMMON NO. IC.                                 SEARCH
C                                                               SEARCH
   12 DO 20 IC=1,KOM                                            SEARCH
      IF (IV.GE.KOUNT(IC).AND.IV.LT.KOUNT(IC+1)) GO TO 22       SEARCH
   20 CONTINUE                                                  SEARCH
      GO TO 99                                                  SEARCH
C                                                               SEARCH
C     COMPUTE ITEM NO. FOR VARIABLE IV IN COMMON IC.            SEARCH
C                                                               SEARCH
   22 K1 = KOUNT(IC)                                            SEARCH
      K2 = IV-1                                                 SEARCH
      ITEM = 1                                                  SEARCH
      IF (K1.EQ.IV) GO TO 25                                    SEARCH
      DO 24 K=K1,K2                                             SEARCH
      NI = 1                                                    SEARCH
      DO 23 I=1,3                                               SEARCH
      IF (NDIM(I,K).NE.0) NI=NI*NDIM(I,K)                       SEARCH
   23 CONTINUE                                                  SEARCH
   24 ITEM = ITEM+NI                                            SEARCH
   25 DO 26 I=1,3                                               SEARCH
      IF (INDEX(I).EQ.0 .AND. NDIM(I,IV).NE.0) GO TO 99         SEARCH
      IF (NDIM(I,IV).EQ.0 .AND. INDEX(I).GT.1) GO TO 99         SEARCH
      NJ(I) = MAX0(INDEX(I)-1,0)                                SEARCH
      NK(I) = MAX0(NDIM(I,IV),1)                                SEARCH
      IF (NJ(I).GE.NK(I)) GO TO 99                              SEARCH
   26 CONTINUE                                                  SEARCH
      ITEM = ITEM+NJ(1)+NJ(2)*NK(1)+NJ(3)*NK(2)*NK(1)           SEARCH
      NCOM = IC                                                 SEARCH
   99 RETURN                                                    SEARCH
      END                                                       SEARCH
                                                                SEARCH
```

```
      SUBROUTINE SEGSEG(M,MM,N,NS,NT)                                   SEGSEG
C                                                  REV IV   02/07/87HYPER
      IMPLICIT REAL*8(A-H,O-Z)                                          SEGSEG
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)SEGSEG
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),SEGSEG
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       SEGSEG
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         SEGSEG
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   SEGSEG
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),SEGSEG
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              SEGSEG
     *               KQ1(12),KQ2(12),KQTYPE(12)                         SEGSEG
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 TGMOD7
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TGMOD7
      COMMON/TEMPVS/DMNT(3,3),TEMP(3,3),B(3,3),XMN(3),RLN(3),XMM(3),    SEGSEG
     *           TM(3),R(3),RM(3),DMNWN(3),RLM(3),RN(3),VMN(3),VR(3),   SEGSEG
     *           WNM(3),WCM(3),WCN(3),VREL(3),FFM(3),FR(3),TQM(3),      SEGSEG
     *           TQN(3),TQNT(3),T(3),H(3),T1(3),T2(3),RMD(3),RND(3),    SEGSEG
     *           TD(3),TT4(3,4),TT5(3,4),T3(3),T4(3),P,AMR,FM,CF,       SEGSEG
     *           VRM,VRT,VRTS,VRTEST,TF,ELOSS,MCF,NCF,T5(3),T6(3)       TGMOD7
     *          ,DMMY(34958)                                            80386
      CALL ELTIME(1,23)                                                 SEGSEG
C                                                                       EDGE
C     COMPUTATIONS ARE DONE IN M'S REFERENCE SYSTEM                     EDGE
      NN = IABS(NS)                                                     SEGSEG
      CALL DOTT33(D(1,1,M),D(1,1,N),DMNT)                               SEGSEG
      DO 10 I = 1,3                                                     SEGSEG
   10 XMN(I) = SEGLP(I,M) - SEGLP(I,N)                                  SEGSEG
      CALL MAT31(D(1,1,M),XMN,XMM)                                      SEGSEG
      J = 3                                                             HYPER
      IF(BD(1,NN).LT.0.0)J = 4                                          HYPER
      CALL MAT31(DMNT,BD(J+1,NN),RLN)                                   HYPER
      J = 3                                                             HYPER
      IF(BD(1,MM).LT.0.0)J = 4                                          HYPER
      DO 15 I = 1,3                                                     EDGE
      J = J + 1                                                         HYPER
   15 R(I) = RLN(I) - XMM(I) - BD(J,MM)                                 HYPER
      LT = NTAB(NT)                                                     SEGSEG
      TB = 1.0                                                          EDGE
      IF((BD(1,MM).GT.0.0).AND.(BD(1,NN).GT.0.0))GO TO 20               HYPER
C NEW HYPERELLIPSOID - AT LEAST ONE SURFACE IS A HYPERELLIPSOID         HYPER
      IF (BD(1,MM).LT.0.0.AND.BD(23,MM).NE.0.0) STOP 23                 HYPER
      IF (BD(1,NN).LT.0.0.AND.BD(23,NN).NE.0.0) STOP 23                 HYPER
C A HYPERELLIPSOID MUST HAVE IDENTICAL POWERS.                          HYPER
C IF(NS.LT.0)    STOP - INTERIOR INTERSECTION NOT OPERATIONAL           HYPER
      IF(NS.LT.0) STOP 38                                               HYPER
      IF(TAB(LT+23).LE.1.0) CALL HYEST(BD(1,MM),BD(1,NN),TAB(LT+22))    HYPER
      IF(TAB(LT+23).GT.1.0) CALL HYNTR(BD(1,MM),BD(1,NN),TAB(LT+22))    HYPER
      BET = TAB(LT+23)                                                  HYPER
      IF(BET.GT.1.0)TB = 1.0/BET                                        HYPER
      GO TO 25                                                          HYPER
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C OLD ELLIPSOIDS                                                       HYPER
   20 IF(NS.LT.0.0)TB = -TB                                            HYPER
      CALL DOTT33(BD(7,NN),DMNT,TEMP)                                  EDGE
      CALL MAT33(DMNT,TEMP,B)                                          EDGE
      CALL INTERS(BD(7,MM),B,R,TB,RM,TAB(LT+22),TM)                    SEGSEG
C                      A    B R    Z       C       AZ                  EDGE
C     INTERS SOLVES (CA + B)Z = BR,   TB = SQRT(Z.AZ)                  EDGE
C                                                                      EDGE
   25 MCF = NTAB(NT+1)                                                 HYPER
      NCF = -MCF                                                       SEGSEG
      IF(NCF.GT.0)CFQQ(NCF) = -999.                                    SEGSEG
C                                                                      EDGE
C     CHECK FOR INTERSECTION                                           EDGE
C                                                                      EDGE
      IF(TB.GE.1.0)GO TO 75                                            HYPER
      S1 = 0.0                                                         SEGSEG
      S2 = 0.0                                                         SEGSEG
      DO 30 I = 1,3                                                    HYPER
      RI = R(I)                                                        SEGSEG
      IF(NS.LT.0)RI = RM(I) + TB*(RM(I) - R(I))                        SEGSEG
      S1 = S1 + RI**2                                                  SEGSEG
   30 S2 = S2 + TM(I)**2                                               HYPER
      AMR = DSQRT(S2)                                                  SEGSEG
      P = (1.0/TB - 1.0)*DSQRT(S1)                                     SEGSEG
      J = 3                                                            HYPER
      IF(BD(1,MM).LT.0.0)J = 4                                         HYPER
      DO 35 I = 1,3                                                    HYPER
      J = J + 1                                                        HYPER
      IF((BD(1,MM).LT.0.0).OR.(BD(1,NN).LT.0.0))RM(I) = TB*RM(I)       HYPER
      TM(I) = -TM(I)/AMR                                               SEGSEG
      T2(I) = RM(I) - R(I)                                             SEGSEG
      RN(I) = T2(I) + RLN(I)                                           SEGSEG
   35 RLM(I) = RM(I) + BD(J,MM)                                        HYPER
      CALL DOT31(DMNT,RN,RLN)                                          SEGSEG
      CALL PLSEGF(M,N,NT)                                              SEGSEG
C                                                                      EDGE
C     STORE PRINT DATA                                                 EDGE
C                                                                      EDGE
      SSF(1,NSSF) = P                                                  SEGSEG
      DO 40 I = 1,3                                                    HYPER
      SSF(I+4,NSSF) = RLM(I)                                           EDGE
   40 SSF(I+7,NSSF) = RLN(I)                                           HYPER
      IF(LPMI(M).NE.0) CALL DOT31(DPMI(1,1,M),RLM,SSF(5,NSSF))         EDGE
      IF(LPMI(N).NE.0) CALL DOT31(DPMI(1,1,N),RLN,SSF(8,NSSF))         EDGE
      IF(MCF.LT.0)GO TO 45                                             HYPER
      SSF(2,NSSF) = FM                                                 SEGSEG
      TF2FM2 = TF**2 - FM**2                                           SEGSEG
      IF(TF2FM2.LT.0.0)TF2FM2 = 0.0                                    SEGSEG
      SSF(3,NSSF) = DSQRT(TF2FM2)                                      SEGSEG
      SSF(4,NSSF) = TF                                                 SEGSEG
      GO TO 75                                                         HYPER
C                                                                      EDGE
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C     ROLL-SLIDE                                                          EDGE
   45 DO 50 I = 1,3                                                       HYPER
   50 SSF(I+1,NSSF) = T(I)                                                HYPER
      IF((BD(1,MM).LT.0.0).OR.(BD(1,NN).LT.0.0)) STOP 29                  HYPER
      ANR = XDY(TM,B,T2)                                                  SEGSEG
      CALL CROSS(TM,WNM,T2)                                               SEGSEG
      CALL MAT31(B,VR,T1)                                                 SEGSEG
      TB = TM(1)*T1(1) + TM(2)*T1(2) + TM(3)*T1(3)                        EDGE
      DO 60 I = 1,3                                                       HYPER
      DO 55 J = 1,3                                                       HYPER
      K = I + 3*(J+1)                                                     SEGSEG
      TT4(I,J) = BD(K,MM)/AMR + B(I,J)/ANR                                SEGSEG
   55 TT5(I,J) = TT4(I,J)                                                 HYPER
      TT4(I,4) = T2(I) - (T1(I) - TB*TM(I))/ANR                           EDGE
   60 TT5(I,4) = TM(I)                                                    HYPER
      CALL DSMSOL(TT4,3,3)                                                SEGSEG
      CALL DSMSOL(TT5,3,3)                                                SEGSEG
      S1 =  TM(1)*TT4(1,4) + TM(2)*TT4(2,4) + TM(3)*TT4(3,4)              EDGE
      S2 = (TM(1)*TT5(1,4) + TM(2)*TT5(2,4) + TM(3)*TT5(3,4))/S1          EDGE
      DO 65 I = 1,3                                                       HYPER
      RMD(I) = TT4(I,4) - S2*TT5(I,4)                                     EDGE
   65 RND(I) = RND(I) + VR(I)                                             HYPER
      CALL CROSS(DMNWN,RND,T1)                                            EDGE
      CALL CROSS(WMEG(1,MM),RMD,T2)                                       EDGE
      CALL MAT31(B,RND,T3)                                                EDGE
      CALL CROSS(DMNWN,TM,T4)                                             EDGE
      S1 = TM(1)*T3(1) + TM(2)*T3(2) + TM(3)*T3(3)                        EDGE
      SQQ(NCF) = 0.0                                                      SEGSEG
      DO 70 I = 1,3                                                       HYPER
      T1(I) = T1(I) - T2(I)                                               EDGE
   70 SQQ(NCF)=SQQ(NCF)+TM(I)*T1(I)-VR(I)*(T4(I)+(T3(I)-S1*TM(I))/ANR)    HYPER
      CALL DOT31(D(1,1,M),T1,RQQ(1,NCF))                                  EDGE
   75 CALL ELTIME(2,23)                                                   HYPER
      RETURN                                                              SEGSEG
      END                                                                 SEGSEG
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      SUBROUTINE SETUP1                                                 SETUP1
C                                                  REV IV    07/24/86SLIP
C     FOR KK=1 (BEFORE CONTACT ROUTINE IN DAUX)                         SETUP1
C     SET UP INITIAL VALUES OF A2 AND B2 ARRAYS FOR THIS TIME POINT.    SETUP1
C     SET UP INITIAL VALUES OF ARRAYS U1,U2 AND V1.                     SETUP1
C                                                                       SETUP1
      IMPLICIT REAL*8(A-H,O-Z)                                          SETUP1
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           SETUP1
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),SETUP1
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       SETUP1
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     SETUP1
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    SETUP1
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),SETUP1
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       SLIP
     *               FE(3,30),TQE(3,30),CONST(5,30)                     SLIP
      COMMON/TEMPVS/T(3),S(3),T1(3),T2(3),T3(3),T4(3),T5(3),T6(3),      SETUP1
     *              T7(3),T8(3),T9(3),T10(3),T11(3),T12(3),HH(3),       SETUP1
     *              TT1(3,3),TT2(3,3),S1,SQS1,S2,S3,S4,V1T,SR2          SLIP
     *            ,DMMY(35043)                                          80386
      DATA IFIRST/1/                                                    SLIP
C                                                                       SETUP1
      CALL ELTIME(1,10)                                                 SETUP1
      IF (IFIRST.EQ.0) GO TO 15                                         SLIP
      IF (NJNT.EQ.0) GO TO 15                                           SLIP
      DO 10 I = 1,NJNT                                                  SLIP
      DO 10 J = 1,3                                                     SLIP
      DO  8 K = 1,3                                                     SLIP
    8 A11(J,K,I) = 0.0                                                  SLIP
   10 A11(J,J,I) = 1.0                                                  SLIP
      IFIRST = 0                                                        SLIP
   15 DO 20 I=1,NGRND                                                   SLIP
C                                                                       SETUP1
C     SET EACH U1N = 0                                                  SETUP1
C                                                                       SETUP1
      U1(1,I) = 0.0                                                     SETUP1
      U1(2,I) = 0.0                                                     SETUP1
      U1(3,I) = 0.0                                                     SETUP1
C                                                                       SETUP1
C     SET EACH U2N = WNX(PHIN*WN)                                       SETUP1
C                                                                       SETUP1
      U2(1,I) = WMEG(2,I)*WMEG(3,I) * (PHI(2,I)-PHI(3,I))               SETUP1
      U2(2,I) = WMEG(1,I)*WMEG(3,I) * (PHI(3,I)-PHI(1,I))               SETUP1
   20 U2(3,I) = WMEG(1,I)*WMEG(2,I) * (PHI(1,I)-PHI(2,I))               SETUP1
      IF (NPRT(11).NE.0) WRITE (6,21) ((U2(I,J),I=1,3),J=1,NSEG)        SETUP1
   21 FORMAT(' U2 ARRAY'/(1X,1P9D14.4))                                 SETUP1
      IF (NJNT.LE.0) GO TO 98                                           SETUP1
      DO 40 J=1,NJNT                                                    SETUP1
      DO 31 K=1,3                                                       SETUP1
      T1(K) = SR(K,2*J-1)                                               SLIP
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      T2(K) = SR(K,2*J  )                                       SLIP
      IF (IABS(IPIN(J)).LT.5) GO TO 31                          SLIP
      IF (IEULER(J).EQ.-1) GO TO 31                             SLIP
      T1(K) = T1(K) + SR(4,2*J-1)*HT(K,3,2*J-1)                 SLIP
   31 V1(K,J) = 0.0                                             SETUP1
      I = IABS(JNT(J))                                          SETUP1
      IF (I.LE.0) GO TO 40                                      SETUP1
C                                                               SETUP1
C     FOR EACH JOINT SET                                        SETUP1
C     B12(2J-1) = B12(J,I  ) = -D(I)' * SR(2J-1) X              SETUP1
C     B12(2J  ) = B12(J,J+1) =  D(J+1)' * SR(2J) X              SETUP1
C                                                               SETUP1
      B12(1,1,2*J-1) = D(3,1,I)*T1(2) - D(2,1,I)*T1(3)          SLIP
      B12(2,1,2*J-1) = D(3,2,I)*T1(2) - D(2,2,I)*T1(3)          SLIP
      B12(3,1,2*J-1) = D(3,3,I)*T1(2) - D(2,3,I)*T1(3)          SLIP
      B12(1,2,2*J-1) = D(1,1,I)*T1(3) - D(3,1,I)*T1(1)          SLIP
      B12(2,2,2*J-1) = D(1,2,I)*T1(3) - D(3,2,I)*T1(1)          SLIP
      B12(3,2,2*J-1) = D(1,3,I)*T1(3) - D(3,3,I)*T1(1)          SLIP
      B12(1,3,2*J-1) = D(2,1,I)*T1(1) - D(1,1,I)*T1(2)          SLIP
      B12(2,3,2*J-1) = D(2,2,I)*T1(1) - D(1,2,I)*T1(2)          SLIP
      B12(3,3,2*J-1) = D(2,3,I)*T1(1) - D(1,3,I)*T1(2)          SLIP
C                                                               SETUP1
      B12(1,1,2*J  ) = D(2,1,J+1)*T2(3) - D(3,1,J+1)*T2(2)      SLIP
      B12(2,1,2*J  ) = D(2,2,J+1)*T2(3) - D(3,2,J+1)*T2(2)      SLIP
      B12(3,1,2*J  ) = D(2,3,J+1)*T2(3) - D(3,3,J+1)*T2(2)      SLIP
      B12(1,2,2*J  ) = D(3,1,J+1)*T2(1) - D(1,1,J+1)*T2(3)      SLIP
      B12(2,2,2*J  ) = D(3,2,J+1)*T2(1) - D(1,2,J+1)*T2(3)      SLIP
      B12(3,2,2*J  ) = D(3,3,J+1)*T2(1) - D(1,3,J+1)*T2(3)      SLIP
      B12(1,3,2*J  ) = D(1,1,J+1)*T2(2) - D(2,1,J+1)*T2(1)      SLIP
      B12(2,3,2*J  ) = D(1,2,J+1)*T2(2) - D(2,2,J+1)*T2(1)      SLIP
      B12(3,3,2*J  ) = D(1,3,J+1)*T2(2) - D(2,3,J+1)*T2(1)      SLIP
C                                                               SETUP1
C     NOTE THAT FOR EACH JOINT                                  SETUP1
C     A21(M,N) = B12(N,M)                                       SETUP1
C                                                               SETUP1
C     FOR EACH JOINT SET                                        SETUP1
C     V1(J) = -D(I)'*W(I)X( W(I)XSR(2J-1) )                     SETUP1
C             +D(J+1)'*W(J+1)X( W(J+1)XSR(2J) )                 SETUP1
C                                                               SETUP1
      CALL CROSS(WMEG(1,I),T1,T)                                SLIP
      CALL CROSS(WMEG(1,I),T,S)                                 SETUP1
      CALL DOT31(D(1,1,I),S,V1(1,J))                            SETUP1
      CALL CROSS(WMEG(1,J+1),T2,T)                              SLIP
      CALL CROSS(WMEG(1,J+1),T,S)                               SETUP1
      CALL DOT31(D(1,1,J+1),S,T)                                SETUP1
      DO 32 K=1,3                                               SLIP
   32 V1(K,J) = T(K) - V1(K,J)                                  SLIP
      IF (IABS(IPIN(J)).LT.5) GO TO 40                          SLIP
      IF (IEULER(J).EQ.-1) GO TO 40                             SLIP
      CALL DOT31(D(1,1,I),HT(1,3,2*J-1),T4)                     SLIP
      CALL CROSS(WMEG(1,I),HT(1,3,2*J-1),T5)                    SLIP
      CALL DOT31(D(1,1,I),T5,T6)                                SLIP
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      V1T = V1(1,J)*T4(1) + V1(2,J)*T4(2) + V1(3,J)*T4(3)                SLIP
      SR2 = 2.0*SR(4,2*J)                                                 SLIP
      DO 34 K = 1,3                                                       SLIP
      V1(K,J) = V1(K,J) - V1T*T4(K) - SR2*T6(K)                           SLIP
      S1=T4(1)*B12(1,K,2*J-1)+T4(2)*B12(2,K,2*J-1)+T4(3)*B12(3,K,2*J-1)   SLIP
      S2=T4(1)*B12(1,K,2*J  )+T4(2)*B12(2,K,2*J  )+T4(3)*B12(3,K,2*J  )   SLIP
      DO 33 L = 1,3                                                       SLIP
      A11(K,L,J) = -T4(K)*T4(L)                                           SLIP
      B12(L,K,2*J-1) = B12(L,K,2*J-1) - S1*T4(L)                          SLIP
   33 B12(L,K,2*J  ) = B12(L,K,2*J  ) - S2*T4(L)                          SLIP
   34 A11(K,K,J) = 1.0 + A11(K,K,J)                                       SLIP
   40 CONTINUE                                                            SETUP1
      IF (NPRT(11).NE.0) WRITE (6,41) ((V1(I,J),I=1,3),J=1,NJNT)          SETUP1
   41 FORMAT(' V1 ARRAY'/(1X,1P9D14.4))                                   SETUP1
C                                                                         SETUP1
C     IF IPIN(M)=1, SET V2(M)=(WN.HN-WM.HM)DN'WNXHN                       SETUP1
C                                                                         SETUP1
      DO 50 J=1,NJNT                                                      SETUP1
      DO 43 K=1,3                                                         SETUP1
   43 V2(K,J) = 0.0                                                       SETUP1
      IF (IPIN(J).LT.1) GO TO 50                                          SETUP1
      IF (IPIN(J).GT.1.AND.IPIN(J).LT.6) GOTO 50                          SLIP
      I = IABS(JNT(J))                                                    SLIP
      CALL CROSS (WMEG(1,I  ),HB(1,2*J-1),T)                              SETUP1
      CALL DOT31 (D(1,1,I  ),T,T1)                                        SETUP1
C     CALL CROSS (WMEG(1,J+1),HB(1,2*J  ),T)                              SETUP1
C     CALL DOT31 (D(1,1,J+1),T,T2)                                        SETUP1
      S1 = WMEG(1,I)*HB(1,2*J-1)                                          SETUP1
     *   + WMEG(2,I)*HB(2,2*J-1)                                          SETUP1
     *   + WMEG(3,I)*HB(3,2*J-1)                                          SETUP1
      S2 = WMEG(1,J+1)*HB(1,2*J)                                          SETUP1
     *   + WMEG(2,J+1)*HB(2,2*J)                                          SETUP1
     *   + WMEG(3,J+1)*HB(3,2*J)                                          SETUP1
      DO 44 K=1,3                                                         SETUP1
C  44 V2(K,J) = S1*T1(K) - S2*T2(K)                                       SETUP1
   44 V2(K,J) = (S1-S2)*T1(K)                                             SETUP1
   50 CONTINUE                                                            SETUP1
   98 CALL ELTIME(2,10)                                                   SETUP1
      RETURN                                                              SETUP1
      END                                                                 SETUP1
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      SUBROUTINE SETUP2                                                 SETUP2
C                                                  REV IV    07/24/86SLIP
C     CALLED BY DAUX AFTER CONTACT ROUTINES AND BY UPDATE PRIOR TO      SETUP2
C     DAUX TO SET UP A2 ARRAY AND (FOR NQ#0) THE A13,A23 AND V3 ARRAYS. SETUP2
C                                                                       SETUP2
      IMPLICIT REAL*8(A-H,O-Z)                                          SETUP2
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           SETUP2
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),SETUP2
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       SETUP2
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     SETUP2
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    SETUP2
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),SETUP2
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   SETUP2
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),SETUP2
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              SETUP2
     *               KQ1(12),KQ2(12),KQTYPE(12)                         SETUP2
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         SETUP2
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      LOGICAL*1 FREE,LDMMY                                              80386
      COMMON/TEMPVS/T(3),S(3),T1(3),T2(3),T3(3),T4(3),T5(3),T6(3),      SETUP2
     *              T7(3),T8(3),T9(3),T10(3),T11(3),T12(3),HH(3),       SETUP2
     *              TT1(3,3),TT2(3,3),S1,SQS1,S2,S3,S4                  SETUP2
     *              ,WCRM(3),RM(3),WCM(3),WWCM(3),WWM(3),RBA (3),BA     SETUP2
     *              ,WCRN(3),RN(3),WCN(3),WWCN(3),WWN(3),RBAD(3)        SETUP2
     *              ,IDUM(14290),FREE(30),LDMMY(2),DMMY(27859)          80386
C                                                                       SETUP2
      CALL ELTIME(1,26)                                                 SETUP2
C                                                                       SETUP2
C     COMPUTE A22 ARRAY VIA DHHPIN FOR DAUX2 ROUTINES.                  SETUP2
C                                                                       SETUP2
      IF (NJNT.EQ.0) GO TO 50                                           SETUP2
      DO 49 M=1,NJNT                                                    SETUP2
      FREE(M) = .TRUE.                                                  SLIP
      N = IABS(JNT(M))                                                  SETUP2
      IF (N.EQ.0) GO TO 49                                              SETUP2
      IF (IPIN(M).EQ.0) GOTO 49                                         SLIP
      IF (IPIN(M).GE.2.AND. IPIN(M).LE.5) GO TO 49                      SLIP
      FREE(M) = .FALSE.                                                 SLIP
      CALL DHHPIN(A22(1,1,2*M-1),T,N  ,M,2*M-1)                         SETUP2
      CALL DHHPIN(A22(1,1,2*M  ),T,M+1,M,2*M  )                         SETUP2
   49 CONTINUE                                                          SETUP2
C                                                                       PECONV
C     THIS STATEMENT IS NECESSARY FOR THE PROGRAM TO RUN ON THE         PECONV
C         P&E FORTRAN VII O (REV 4) COMPILER                            PECONV
C                                                                       PECONV
      NNNET = IPIN(M)                                                   PECONV
C                                                                       SETUP2
C     SET UP A13,A23 AND V3 ARRAYS FOR DAUX33.                          SETUP2
C                                                                       SETUP2
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```
   50 IF (NQ.EQ.0) GO TO 98                                        SETUP2
      DO 70 K=1,NQ                                                 SETUP2
      IF (KQTYPE(K).LT.0) GO TO 70                                 SETUP2
      IF (KQTYPE(K).EQ.5) GO TO 70                                 SETUP2
      M = KQ1(K)                                                   SETUP2
      N = KQ2(K)                                                   SETUP2
      IF (KQTYPE(K).EQ.2 .OR. KQTYPE(K).EQ.4) GO TO 53             SETUP2
C                                                                  SETUP2
C     FOR KQTYPE = 1 OR 3, SET HHT = I                             SETUP2
C                                                                  SETUP2
      DO 52 J=1,3                                                  SETUP2
      DO 51 I=1,3                                                  SETUP2
   51 HHT(I,J,K) = 0.0                                             SETUP2
   52 HHT(J,J,K) = 1.0                                             SETUP2
      IF (KQTYPE(K).NE.6) GO TO 61                                 SETUP2
C                                                                  SETUP2
C     FOR KQTYPE=6, SET HHT= I-TT'                                 SETUP2
C                                                                  SETUP2
      DO 60 J=1,3                                                  SETUP2
      DO 60 I=1,3                                                  SETUP2
   60 HHT(I,J,K) = HHT(I,J,K) - TQQ(I,K)*TQQ(J,K)                  SETUP2
      GO TO 61                                                     SETUP2
   53 IF (KQTYPE(K).NE.2) GO TO 56                                 SETUP2
C                                                                  SETUP2
C     FOR KQTYPE=2, COMPUTE HH AND HHT.                            SETUP2
C                                                                  SETUP2
      CALL DOT31(D(1,1,M),RK1(1,K),T1)                             SETUP2
      CALL DOT31(D(1,1,N),RK2(1,K),T2)                             SETUP2
      S1 = 0.0                                                     SETUP2
      DO 54 I=1,3                                                  SETUP2
      HH(I) = SEGLP(I,M)+T1(I) - SEGLP(I,N)-T2(I)                  SETUP2
   54 S1 = S1 + HH(I)**2                                           SETUP2
      SQS1 = DSQRT(S1)                                             SETUP2
      DO 55 I=1,3                                                  SETUP2
      HH(I) = HH(I)/SQS1                                           SETUP2
   55 IF (DABS(HH(I)).LE.EPS(12)) HH(I) = 0.0                      SETUP2
      CALL DOTT31(HH,HH,HHT(1,1,K))                                SETUP2
   56 IF (KQTYPE(K).NE.4) GO TO 61                                 SETUP2
C                                                                  SETUP2
C     FOR KQTYPE = 4, SET HHT = HHT                                SETUP2
C                                                                  SETUP2
      CALL DOTT31(HQQ(1,K),HQQ(1,K),HHT(1,1,K))                    SETUP2
C                                                                  SETUP2
C     SET A13(2K-1) =  HHT                                         SETUP2
C     AND A13(2K)   = -HHT                                         SETUP2
C                                                                  SETUP2
   61 DO 62 J=1,3                                                  SETUP2
      DO 62 I=1,3                                                  SETUP2
      A13(I,J,2*K-1) =  HHT(I,J,K)                                 SETUP2
   62 A13(I,J,2*K  ) = -HHT(I,J,K)                                 SETUP2
C                                                                  SETUP2
C     SET A23(2K-1) = (R1X)(D1)A13(2K-1)                           SETUP2
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```
C     AND A23(2K)   = (R2X)(D2)A13(2K)                              SETUP2
C                                                                   SETUP2
      CALL MAT33(D(1,1,M),A13(1,1,2*K-1),TT1)                       SETUP2
      CALL MAT33(D(1,1,N),A13(1,1,2*K  ),TT2)                       SETUP2
      DO 63 J=1,3                                                   SETUP2
      CALL CROSS(RK1(1,K),TT1(1,J),A23(1,J,2*K-1) )                 SETUP2
   63 CALL CROSS(RK2(1,K),TT2(1,J),A23(1,J,2*K  ) )                 SETUP2
      IF (KQTYPE(K).EQ.4) GO TO 72                                  SETUP2
C                                                                   SETUP2
C     FOR KQTYPE = 1,2 OR 3, SET B31 = A13' AND B32 = A23'          SETUP2
C                                                                   SETUP2
      DO 71 I=1,3                                                   SETUP2
      DO 71 J=1,3                                                   SETUP2
      B31(I,J,2*K-1) = A13(J,I,2*K-1)                               SETUP2
      B31(I,J,2*K  ) = A13(J,I,2*K  )                               SETUP2
      B32(I,J,2*K-1) = A23(J,I,2*K-1)                               SETUP2
   71 B32(I,J,2*K  ) = A23(J,I,2*K  )                               SETUP2
      GO TO 76                                                      SETUP2
C                                                                   SETUP2
C     FOR KQTYPE = 4, SET B31(2K-1) =  HTT                          SETUP2
C                         B31(2K  ) = -HTT                          SETUP2
C                         B32       = (B31)(D')(RX)'                SETUP2
C                                                                   SETUP2
   72 CALL DOTT31(HQQ(1,K),TQQ(1,K),B31(1,1,2*K-1))                 SETUP2
      DO 73 I=1,3                                                   SETUP2
      DO 73 J=1,3                                                   SETUP2
   73 B31(I,J,2*K) = -B31(I,J,2*K-1)                                SETUP2
      CALL DOTT33(D(1,1,M),B31(1,1,2*K-1),B32(1,1,2*K-1))           SETUP2
      CALL DOTT33(D(1,1,N),B31(1,1,2*K  ),B32(1,1,2*K  ))           SETUP2
      DO 74 J=1,3                                                   SETUP2
      CALL CROSS(RK1(1,K),B32(1,J,2*K-1),TT1(1,J))                  SETUP2
   74 CALL CROSS(RK2(1,K),B32(1,J,2*K  ),TT2(1,J))                  SETUP2
      DO 75 I=1,3                                                   SETUP2
      DO 75 J=1,3                                                   SETUP2
      B32(I,J,2*K-1) = TT1(J,I)                                     SETUP2
   75 B32(I,J,2*K  ) = TT2(J,I)                                     SETUP2
C                                                                   SETUP2
C     COMPUTE V3 = D2'(W2X(W2XR2)) - D1'(W1X(W1XR1))                SETUP2
C                                                                   SETUP2
   76 CALL CROSS(WMEG(1,M),RK1(1,K),T3)                             SETUP2
      CALL CROSS (WMEG(1,M),T3,T4)                                  SETUP2
      CALL DOT31 (D(1,1,M),T4,T5)                                   SETUP2
      CALL CROSS (WMEG(1,N),RK2(1,K),T6)                            SETUP2
      CALL CROSS (WMEG(1,N),T6,T7)                                  SETUP2
      CALL DOT31 (D(1,1,N),T7,T8)                                   SETUP2
      DO 64 I=1,3                                                   SETUP2
   64 V3(I,K) = T8(I) - T5(I)                                       SETUP2
      IF (KQTYPE(K).NE.2) GO TO 67                                  SETUP2
C                                                                   SETUP2
C     RECOMPUTE V3 FOR KQTYPE=2.                                    SETUP2
C                                                                   SETUP2
      CALL DOT31 (D(1,1,M),T3,T9 )                                  SETUP2
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      CALL DOT31 (D(1,1,N),T6,T10)                                            SETUP2
      S2 = 0.0                                                                SETUP2
      DO 65 I=1,3                                                             SETUP2
      T11(I) = SEGLV(I,M)+T9(I) - SEGLV(I,N)-T10(I)                           SETUP2
   65 S2 = S2 + T11(I)**2                                                     SETUP2
      S3 = HH(1)*V3(1,K) + HH(2)*V3(2,K) + HH(3)*V3(3,K)                      SETUP2
      S4 = S3-S2/SQS1                                                         SETUP2
      DO 66 I=1,3                                                             SETUP2
   66 V3(I,K) = S4*HH(I)                                                      SETUP2
   67 IF (KQTYPE(K).NE.3.AND.KQTYPE(K).NE.6) GO TO 77                         SETUP2
C                                                                             SETUP2
C     FOR KQTYPE=3 OR 6, ADD R DOT TERM FROM PLELP OR SEGSEG TO V3.           SETUP2
C                                                                             SETUP2
      DO 68 I=1,3                                                             SETUP2
   68 V3(I,K) = V3(I,K) + RQQ(I,K)                                            SETUP2
      IF (KQTYPE(K).NE.6)  GO TO 70                                           SETUP2
C                                                                             SETUP2
C     FOR KQTYPE=6, SET V3 = (I-TT')(V3+RQQ)                                  SETUP2
C                                                                             SETUP2
      VQQ = V3(1,K)*TQQ(1,K) + V3(2,K)*TQQ(2,K) + V3(3,K)*TQQ(3,K)            SETUP2
      DO 69 I=1,3                                                             SETUP2
   69 V3(I,K) = V3(I,K) - VQQ*TQQ(I,K)                                        SETUP2
   77 IF (KQTYPE(K).NE.4) GO TO 70                                            SETUP2
C                                                                             SETUP2
C     FOR KQTYPE = 4, ADD R TERM FROM PLELP OR SEGSEG TO V3.                  SETUP2
C                                                                             SETUP2
      S3 = TQQ(1,K)*V3(1,K) + TQQ(2,K)*V3(2,K) + TQQ(3,K)*V3(3,K)            SETUP2
      S4 = S3+SQQ(K)                                                          SETUP2
      DO 78 I=1,3                                                             SETUP2
   78 V3(I,K) = S4*HQQ(I,K)                                                   SETUP2
   70 CONTINUE                                                                SETUP2
C                                                                             SETUP2
C     SPECIAL SETUP FOR TENSION ELEMENTS (KQTYPE = 5).                        SETUP2
C                                                                             SETUP2
      N = 0                                                                   SETUP2
   79 N = N+1                                                                 SETUP2
      IF (N.GE.NQ) GO TO 98                                                   SETUP2
      IF (KQTYPE(N).NE.5) GO TO 79                                            SETUP2
      DO 81 I=1,3                                                             SETUP2
      DO 80 J=1,3                                                             SETUP2
      A13(I,J,2*N-1) = 0.0                                                    SETUP2
      A13(I,J,2*N  ) = 0.0                                                    SETUP2
      A23(I,J,2*N  ) = 0.0                                                    SETUP2
      B31(I,J,2*N-1) = 0.0                                                    SETUP2
      B31(I,J,2*N  ) = 0.0                                                    SETUP2
      A13(I,J,2*N+1) = 0.0                                                    SETUP2
      A13(I,J,2*N+2) = 0.0                                                    SETUP2
      A23(I,J,2*N+1) = 0.0                                                    SETUP2
      B31(I,J,2*N+1) = 0.0                                                    SETUP2
      B31(I,J,2*N+2) = 0.0                                                    SETUP2
      HHT(I,J,N    ) = 0.0                                                    SETUP2
   80 HHT(I,J,N+1  ) = 0.0                                                    SETUP2
                                                                              SETUP2
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      A13(I,I,2*N-1) = 1.0                                            SETUP2
      B31(I,I,2*N-1) = RK1(1,N+1)                                     SETUP2
      B31(I,I,2*N  ) = RK1(3,N+1)                                     SETUP2
      A13(I,I,2*N+2) = 1.0                                            SETUP2
      B31(I,I,2*N+1) = RK1(3,N+1)                                     SETUP2
   81 B31(I,I,2*N+2) = RK1(2,N+1)                                     SETUP2
      N1 = KQ1(N)                                                     SETUP2
      N2 = KQ2(N)                                                     SETUP2
      DO 82 K=1,3                                                     SETUP2
      CALL CROSS(RK1(1,N),D(1,K,N1),A23(1,K,2*N-1))                   SETUP2
   82 CALL CROSS(RK2(1,N),D(1,K,N2),A23(1,K,2*N+2))                   SETUP2
      DO 83 I=1,3                                                     SETUP2
      DO 83 J=1,3                                                     SETUP2
      B32(I,J,2*N-1) = RK1(1,N+1)*A23(J,I,2*N-1)                      SETUP2
      B32(I,J,2*N  ) = RK1(3,N+1)*A23(J,I,2*N+2)                      SETUP2
      B32(I,J,2*N+1) = RK1(3,N+1)*A23(J,I,2*N-1)                      SETUP2
   83 B32(I,J,2*N+2) = RK1(2,N+1)*A23(J,I,2*N+2)                      SETUP2
      CALL CROSS(WMEG(1,N1),RK1(1,N),WCRM)                            SETUP2
      CALL CROSS(WMEG(1,N2),RK2(1,N),WCRN)                            SETUP2
      CALL DOT31(D(1,1,N1),RK1(1,N),RM)                               SETUP2
      CALL DOT31(D(1,1,N2),RK2(1,N),RN)                               SETUP2
      CALL DOT31(D(1,1,N1),WCRM,WCM)                                  SETUP2
      CALL DOT31(D(1,1,N2),WCRN,WCN)                                  SETUP2
      BA = 0.0                                                        SETUP2
      DO 84 I=1,3                                                     SETUP2
      RBA (I) = SEGLP(I,N2) + RN (I) - SEGLP(I,N1) - RM (I)           SETUP2
      RBAD(I) = SEGLV(I,N2) + WCN(I) - SEGLV(I,N1) - WCM(I)           SETUP2
   84 BA = BA + RBA(I)**2                                             SETUP2
      BA = DSQRT(BA)                                                  SETUP2
      FORCE = 0.0                                                     SETUP2
      IF (BA.GT.RK2(3,N+1)) FORCE = RK2(1,N+1)*(1.0-RK2(3,N+1)/BA)    SETUP2
      DO 85 I=1,3                                                     SETUP2
      V3(I,N) = RK2(2,N+1)*RBAD(I) + FORCE*RBA(I)                     SETUP2
   85 V3(I,N+1) = -V3(I,N)                                            SETUP2
      CALL CROSS(WMEG(1,N1),WCRM,WWCM)                                SETUP2
      CALL CROSS(WMEG(1,N2),WCRN,WWCN)                                SETUP2
      CALL DOT31(D(1,1,N1),WWCM,WWM)                                  SETUP2
      CALL DOT31(D(1,1,N2),WWCN,WWN)                                  SETUP2
      DO 86 I=1,3                                                     SETUP2
      V3(I,N  ) = V3(I,N  ) - RK1(1,N+1)*WWM(I) - RK1(3,N+1)*WWN(I)   SETUP2
   86 V3(I,N+1) = V3(I,N+1) - RK1(3,N+1)*WWM(I) - RK1(2,N+1)*WWN(I)   SETUP2
      N = N+1                                                         SETUP2
      GO TO 79                                                        SETUP2
   98 CALL ELTIME(2,26)                                               SETUP2
      RETURN                                                          SETUP2
      END                                                             SETUP2
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      SUBROUTINE SINPUT                                                SINPUT
C                                                    REV IV    02/20/87HYPER
C     READS AND PRINTS THE INPUT CARDS THAT DESCRIBE THE PHYSICAL     SINPUT
C     DIMENSIONS OF THE PLANES REPRESENTING THE VEHICLE PANELS AND OF SINPUT
C     THE RESTRAINT BELTS. ALSO PROCESSES THOSE DATA CARDS THAT DESCRIBESINPUT
C     ADDITIONAL CONTACT ELLIPSOIDS, CONSTRAINTS, BODY SEGMENT SYMMETRY SINPUT
C     OPTIONS AND SPRING DAMPER FUNCTIONS.                             SINPUT
C                                                                      SINPUT
      IMPLICIT REAL*8 (A-H,O-Z)                                        SINPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,          SINPUT
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG   PAGE
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)          EDGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),SINPUT
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)      SINPUT
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),  SINPUT
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),SINPUT
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),             SINPUT
     *               KQ1(12),KQ2(12),KQTYPE(12)                        SINPUT
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),          SINPUT
     *               BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),      SINPUT
     *               JOINT(30),CGS(30),JS(30)                          SINPUT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT     SINPUT
      LOGICAL*1 CGS,JS,LP4                                             HYPER
      COMMON/DAMPER/ APSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)SINPUT
      COMMON/WINDFR/ WTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),   WINDOP
     *               MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)      WINDOP
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                        SINPUT
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                 TWOPI
      COMMON/TEMPVS/ P1(3),P2(3),P3(3),P4(3),DE(3,3),DMMY(35092)       80386
      DIMENSION IDYPR(3)                                               SINPUT
      DATA IDYPR/3,2,1/                                                SINPUT
      DATA MAXBD/40/                                                   CHGIII
      DATA NPLMAX/30/,NBLTMX/8/,NBAGMX/5/,NELPMX/40/,NQMAX/12/,        MISC
     *     NSDMAX/20/,NHRNSM/5/,NWINDM/50/,NJNTFM/50/,NFORCM/5/        MISC
C                                                                      SINPUT
C     INPUT CARD D.1                                                   SINPUT
C                                                                      SINPUT
      READ  (5,11)  NPL,NBLT,NBAG,NELP,NQ,NSD,NHRNSS,NWINDF,NJNTF,NFORCESINPUT
   11 FORMAT(12I6)                                                     SINPUT
      WRITE (6,16) NPG,NPL,NBLT,NBAG,NELP,NQ,NSD,NHRNSS,NWINDF,NJNTF,  PAGE
     *             NFORCE                                              PAGE
      NPG=NPG+1                                                        PAGE
   16 FORMAT('1     NPL     NBLT     NBAG     NELP       NQ      NSD  NHRNSS',PAGE
     *     '  NWINDF   NJNTF  NFORCE',43X,'PAGE',I5/10I8,40X,'CARD D.1')PAGE
      IF (NPL.GT.NPLMAX) STOP 65                                       CHGIII
      IF (NBLT.GT.NBLTMX) STOP 66                                      MISC
      IF (NBAG.GT.NBAGMX) STOP 67                                      MISC
      IF (NELP.GT.NELPMX) STOP 68                                      MISC
      IF (NQ.GT.NQMAX) STOP 69                                         CHGIII
      IF (NSD.GT.NSDMAX) STOP 70                                       CHGIII
      IF (NHRNSS.GT.NHRNSM) STOP 71                                    MISC
      IF (NWINDF.GT.NWINDM) STOP 72                                    MISC
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      IF (NJNTF.GT.NJNTFM) STOP 73                                      MISC
      IF (NFORCE.GT.NFORCM) STOP 74                                     MISC
      IF (NPL.EQ.0) GO TO 15                                            SINPUT
      IPAGE = 0                                                         SINPUT
      DO 20 J=1,NPL                                                     SINPUT
C                                                                       SINPUT
C     READ AND PRINT CARDS D.2.A,D.2.B AND D.2.C FOR THE JTH PLANE.     SINPUT
C                                                                       SINPUT
      READ (5,23) JJ,(PLTTL(I,J),I = 1,5),P1,P2,P3                      SINPUT
   23 FORMAT (I4,4X,5A4/(3F12.0))                                       SINPUT
      IF (JJ.NE.J) WRITE (6,24) JJ,J                                    SINPUT
   24 FORMAT (' PLANE INDEX INPUT ERROR,',2I4)                          SINPUT
      IF  (JJ.NE.J)  STOP 10                                            SINPUT
      IF (MOD(J,7).EQ.1.AND.IPAGE.EQ.0) WRITE (6,12) IPAGE              PAGE
      IF (MOD(J,7).EQ.1.AND.IPAGE.EQ.1) WRITE (6,112) IPAGE,NPG         PAGE
      IF (MOD(J,7).EQ.1.AND.IPAGE.EQ.1) NPG=NPG+1                       PAGE
  112 FORMAT(I1,' PLANE INPUTS',109X,'PAGE',I5/120X,'CARDS D.2')        PAGE
   12 FORMAT(I1,' PLANE INPUTS',106X,'CARDS D.2')                       SINPUT
      IPAGE = 1                                                         SINPUT
      WRITE (6,25) J, (PLTTL(I,J),I = 1,5),P1,P2,P3                     SINPUT
   25 FORMAT('0 PLANE NO.',I4,4X,5A4//17X,'X',11X,'Y',11X,'Z'/          SINPUT
     *       '  POINT 1 ' ,3F12.4/                                      SINPUT
     *       '  POINT 2 ' ,3F12.4/                                      SINPUT
     *       '  POINT 3 ' ,3F12.4)                                      SINPUT
C                                                                       SINPUT
C     PROGRAM NOW ASSUMES THE FINITE PLANE IS A PARALLELOGRAM IN SHAPE  SINPUT
C     WHERE THE INPUT POINTS P1,P2,P3 ARE 3 OF THE CORNERS SUCH THAT    SINPUT
C     EDGE P1-P2 IS LESS THAN 180 DEGREES CLOCKWISE (AS VIEWED BY THE   SINPUT
C     OCCUPANT) FROM THE EDGE P1-P3.                                    SINPUT
C                                                                       SINPUT
C     SET UP PL ARRAY AS REQUIRED BY SUBROUTINE PLELP                   SINPUT
C                                                                       SINPUT
C         PL(1,J) = A0   NORMAL EQUATION OF JTH PLACE                   SINPUT
C         PL(2,J) = B0     A0*X + B0*Y + C0*Z = D0                      SINPUT
C         PL(3,J) = C0                                                  SINPUT
C         PL(4,J) = D0                                                  SINPUT
C                                                                       SINPUT
C         PL(5,J)                                                       SINPUT
C         PL(6,J)        POINT 1                                        EDGE
C         PL(7,J)                                                       SINPUT
C                                                                       SINPUT
C         PL(8,J) =A1                                                   SINPUT
C         PL(9,J) =B1    NORMAL EQUATION OF 1ST BOUNDARY PLANE          SINPUT
C         PL(10,J)=C1      A1*X + B1*Y + C1*Z = D1                      SINPUT
C         PL(11,J)=D1    AND E1 IS LENGTH OF PLANE FROM BOUNDARY.       SINPUT
C         PL(12,J)=E1                                                   SINPUT
C                                                                       SINPUT
C         PL(13,J)=A2                                                   SINPUT
C         PL(14,J)=B2    NORMAL EQUATION OF 2ND BOUNDARY PLANE          SINPUT
C         PL(15,J)=C2      A2*X + B2*Y + C2*Z = D2                      SINPUT
C         PL(16,J)=D2    AND E2 IS LENGTH OF PLANE FROM BOUNDARY.       SINPUT
C         PL(17,J)=E2                                                   SINPUT
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C                                                                         SINPUT
C        PL(18,J)                                                         EDGE
C        PL(19,J)       POINT 2 - POINT 1                                 EDGE
C        PL(20,J)                                                         EDGE
C                                                                         EDGE
C        PL(21,J)                                                         EDGE
C        PL(22,J)       POINT 3 - POINT 1                                 EDGE
C        PL(23,J)                                                         EDGE
C                                                                         EDGE
C        PL(24,J)       NOT CURRENTLY USED                                EDGE
      S22 = 0.0                                                           SINPUT
      S23 = 0.0                                                           SINPUT
      S33 = 0.0                                                           SINPUT
      DO 26 I =1,3                                                        SINPUT
      P2(I) = P2(I)-P1(I)                                                 SINPUT
      P3(I) = P3(I)-P1(I)                                                 SINPUT
      PL(I+ 4,J) = P1(I)                                                  EDGE
      PL(I+17,J) = P2(I)                                                  EDGE
      PL(I+20,J) = P3(I)                                                  EDGE
      S22 = S22 + P2(I)*P2(I)                                             SINPUT
      S23 = S23 + P2(I)*P3(I)                                             SINPUT
   26 S33 = S33 + P3(I)*P3(I)                                             SINPUT
      S2  = DSQRT(S22)                                                    SINPUT
      S3  = DSQRT(S33)                                                    SINPUT
      CALL CROSS(P2,P3,PL(1,J))                                           SINPUT
      S1 = 0.0                                                            SINPUT
      DO 27 I=1,3                                                         SINPUT
   27 S1 = S1 + PL(I,J)**2                                                SINPUT
      S1 = DSQRT(S1)                                                      SINPUT
      DO 28 I=1,3                                                         SINPUT
      PL(I,J) = PL(I,J)/S1                                                SINPUT
      PL(I+7 ,J) = (S33*P2(I) - S23*P3(I)) / (S1*S3)                      SINPUT
   28 PL(I+12,J) = (S22*P3(I) - S23*P2(I)) / (S1*S2)                      SINPUT
      PL( 4,J) = P1(1)*PL( 1,J) + P1(2)*PL( 2,J) + P1(3)*PL( 3,J)         SINPUT
      PL(11,J) = P1(1)*PL( 8,J) + P1(2)*PL( 9,J) + P1(3)*PL(10,J)         SINPUT
      PL(12,J) = P2(1)*PL( 8,J) + P2(2)*PL( 9,J) + P2(3)*PL(10,J)         SINPUT
      PL(16,J) = P1(1)*PL(13,J) + P1(2)*PL(14,J) + P1(3)*PL(15,J)         SINPUT
   20 PL(17,J) = P3(1)*PL(13,J) + P3(2)*PL(14,J) + P3(3)*PL(15,J)         SINPUT
   15 IF (NBLT.EQ.0) GO TO 35                                             SINPUT
      DO 30 J=1,NBLT                                                      SINPUT
C                                                                         SINPUT
C     READ AND PRINT CARDS D.3.A, D.3.B AND D.3.C FOR THE JTH BELT.       SINPUT
C                                                                         SINPUT
      READ (5,13) (BLTTTL(I,J),I = 1,5),(BELT(I,J),I = 1,11)              SINPUT
   13 FORMAT (5A4/(6F12.0))                                               SINPUT
      IF (MOD(J,5).EQ.1) WRITE (6,21) NPG                                 PAGE
      IF (MOD(J,5).EQ.1) NPG=NPG+1                                        PAGE
   21 FORMAT('1 BELT INPUTS',110X,'PAGE',I5/120X,'CARDS D.3')             PAGE
   30 WRITE (6,14) J,(BLTTTL(I,J),I = 1,5),(BELT(I,J),I = 1,11)           SINPUT
   14 FORMAT('0 BELT NO.',I4,4X,5A4//                                     SINPUT
     *    30X,'ANCHOR POINT A',46X,'ANCHOR POINT B'/                      SINPUT
     *    2(16X,'X',19X,'Y',19X,'Z',3X)/6F20.3//                          SINPUT
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     *    26X,'FIXED POINT ON SEGMENT',45X,'SLACK(+)'/                       SINPUT
     *    16X,'X',19X,'Y',19X,'Z',17X,'BLANK',13X,'LENGTH(-)'/5F20.3)        SINPUT
C                                                                            SINPUT
C     CALL AIRBG1 ROUTINE IF REQUIRED FOR AIRBAG INPUT                       SINPUT
C                                                                            SINPUT
   35 IF (NBAG.NE.0) CALL AIRBG1                                             SINPUT
      IF (NELP.LE.0) GO TO 51                                                SINPUT
C                                                                            SINPUT
C     READ AND PRINT CARDS D.5 FOR ELLIPSOID INPUT, IF ANY.                  SINPUT
C       NOTE: NELP IS THE NO. OF ELLIPSOIDS TO BE SUPPLIED HERE, NOT THESINPUT
C             NO. OF ELLIPSOIDS IN THE PROGRAM, SINCE THE FIRST NSEG         SINPUT
C             ELLIPSOIDS WERE SUPPLIED ON CARDS B.2.A - B.2.I. HOWEVER       SINPUT
C             THEY MAY BE REPLACED HERE IF DESIRED.                          SINPUT
C                                                                            SINPUT
      WRITE (6,41) NPG,UNITL,UNITL                                           PAGE
      NPG=NPG+1                                                              PAGE
   41 FORMAT('1 ADDITIONAL ELLIPSOID INPUT',95X,'PAGE',I5/120X,              PAGE
     *  'CARDS D.5'/17X,'SEMIAXES (',A4,')',18X,'OFFSET (',A4,')',           PAGE
     *  20X,'ROTATION (DEG)',15X,'POWER'/                                    HYPER
     *  3X,'NO.',2(8X,'X',8X,'Y',8X,'Z',6X),7X,'YAW',7X,'PITCH',5X,          SINPUT
     *  'ROLL'//)                                                            SINPUT
      DO 50 MM=1,NELP                                                        SINPUT
      READ (5,42) M,P1,P2,P3,P4                                              HYPER
   42 FORMAT(I6,9F6.0,3F4.0)                                                 HYPER
      IF (M.GT.MAXBD) STOP 63                                                CHGIII
C                                                                            CHGIII
C     PREVENT EXTRA ELLIPSOIDS FROM CHANGING AIRBAG ELLIPSOIDS               CHGIII
C                                                                            CHGIII
      IF (M.GT.NVEH.AND.M.LT.NGRND) WRITE (6,330)                            CHGIII
  330 FORMAT(3X,'THE EXTRA CONTACT ELLIPSOID NUMBER IS THE SAME AS AN AICHGIII
     *RBAG ELLIPSOID')                                                       CHGIII
      IF (M.GT.NVEH.AND.M.LT.NGRND) STOP 64                                  CHGIII
      WRITE (6,43) M,P1,P2,P3,P4                                             HYPER
   43 FORMAT(I6,3(3X,3F9.3,3X),3F6.0)                                        HYPER
      CALL DRCYPR (DE,P3,IDYPR)                                              SINPUT
      N = 1                                                                  HYPER
      LP4 = .FALSE.                                                          HYPER
      DO 39 J = 1,3                                                          HYPER
   39 IF (P4(J).GT.2.0) LP4 = .TRUE.                                         HYPER
      IF (LP4) N = 2                                                         HYPER
      DO 46 I = 1,3                                                          HYPER
      BD(N  ,M) = P1(I)                                                      HYPER
      BD(N+3,M) = P2(I)                                                      HYPER
      IF (LP4) GO TO 46                                                      HYPER
      DO 45 J=1,3                                                            SINPUT
      SUM1 = 0.0                                                             SINPUT
      SUM2 = 0.0                                                             SINPUT
      DO 44 L=1,3                                                            SINPUT
      SUM1 = SUM1 + DE(L,I)/P1(L)**2*DE(L,J)                                 SINPUT
   44 SUM2 = SUM2 + DE(L,I)*P1(L)**2*DE(L,J)                                 SINPUT
      K = 3*I +J +3                                                          SINPUT
      BD(K  ,M) = SUM1                                                       SINPUT
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   45 BD(K+9,M) = SUM2                                                SINPUT
   46 N = N + 1                                                       HYPER
      IF (.NOT.LP4) GO TO 50                                          HYPER
      BD(1,M) = -P4(1)                                                HYPER
      N = 8                                                           HYPER
      DO 48 J = 1,3                                                   HYPER
      BD(J+19,M) = P4(J)                                              HYPER
      IF (BD(J+19,M).EQ.0.0) BD(J+19,M) = BD(20,M)                    HYPER
      BD(J+16,M) = 1.0/BD(J+1,M)**2                                   HYPER
      DO 48 I = 1,3                                                   HYPER
      BD(N,M) = DE(I,J)                                               HYPER
   48 N = N + 1                                                       HYPER
      BD(23,M) = 0.0                                                  HYPER
      IF (BD(20,M).NE.BD(21,M)) BD(23,M) = 1.0                        HYPER
      IF (BD(21,M).NE.BD(22,M)) BD(23,M) = 1.0                        HYPER
      IF (BD(22,M).NE.BD(20,M)) BD(23,M) = 1.0                        HYPER
   50 CONTINUE                                                        SINPUT
C                                                                     SINPUT
C     READ AND PRINT CARDS D.6 FOR CONSTRAINT INPUT, IF ANY.          SINPUT
C                                                                     SINPUT
   51 IF (NQ.LE.0) GO TO 70                                           SINPUT
      DO 60 K=1,NQ                                                    SINPUT
      READ (5,52) KQTYPE(K),KQ1(K),KQ2(K),(RK1(I,K),I=1,3)            SINPUT
     *                                   ,(RK2(I,K),I=1,3)            SINPUT
   52 FORMAT(3I6,6F6.0)                                               SINPUT
      IF (K.EQ.1) WRITE (6,53) NPG,UNITL,UNITL                        PAGE
      IF (K.EQ.1) NPG=NPG+1                                           PAGE
   53 FORMAT('1 CONSTRAINT INPUT',105X,'PAGE',I5/120X,'CARDS D.6'/    PAGE
     *       '  TYPE   SEGMENT  SEGMENT       POINT ON 1ST SEGMENT (', SINPUT
     *       A4,')','      POINT ON 2ND SEGMENT (',A4,')'/            SINPUT
     *       '    NO.    NO. 1    NO. 2          X         Y        Z  SINPUT
     *          X         Y         Z'//)                             SINPUT
      WRITE (6,54)  KQTYPE(K),KQ1(K),KQ2(K),(RK1(I,K),I=1,3)          SINPUT
     *                                     ,(RK2(I,K),I=1,3)          SINPUT
   54 FORMAT(I6,2I9,2(6X,3F9.3) )                                     SINPUT
   60 CONTINUE                                                        SINPUT
C                                                                     SINPUT
C     CARD D.7  BODY SEGMENT SYMMETRY INPUT                           SINPUT
C                                                                     SINPUT
   70 READ (5,71) (NSYM(J),J=1,NSEG)                                  SINPUT
   71 FORMAT(18I4)                                                    SINPUT
      DO 103 J=1,NSEG                                                 TGMOD2
      LJ = NSYM(J)                                                    TGMOD2
      IF(IABS(LJ).GT.NSEG) GO TO 107                                  TGMOD2
      IF(LJ) 104,103,105                                              TGMOD2
  105 LK = NSYM(LJ)                                                   TGMOD2
      IF(IABS(LK).GT.NSEG) GO TO 107                                  TGMOD2
      IF(LK.NE.J) GO TO 106                                           TGMOD2
      GO TO 103                                                       TGMOD2
  104 JJ = -J                                                         TGMOD2
      LJ = -LJ                                                        TGMOD2
      LK = NSYM(LJ)                                                   TGMOD2
```

```
      IF(IABS(LK).GT.NSEG) GO TO 107                                    TGMOD2
      IF((LK.NE.JJ).OR.(NSYM(J).EQ.JJ)) GO TO 106                       TGMOD2
      GO TO 103                                                         TGMOD2
  106 STOP 96                                                           TGMOD2
  107 STOP 97                                                           TGMOD2
  103 CONTINUE                                                          TGMOD2
      WRITE(6,72) (J,J=1,NSEG)                                          SINPUT
      WRITE(6,73) (NSYM(J),J=1,NSEG)                                    SINPUT
   72 FORMAT('0 BODY SEGMENT SYMMETRY INPUT',91X,'CARD D.7'//           SINPUT
     *       '  SEG NO.',30I4)                                          SINPUT
   73 FORMAT('0 NSYM(J)',30I4)                                          SINPUT
      NSEG1 = NSEG+1                                                    SINPUT
      DO 74 J=NSEG1,NGRND                                               SINPUT
   74 NSYM(J) = 0                                                       SINPUT
      IF  (NSD.LE.0)  GO TO 90                                          SINPUT
C                                                                       SINPUT
C     CARD D.8   SPRING DAMPERS FUNCTION INPUT.                         SINPUT
C                                                                       SINPUT
      DO 79 J=1,NSD                                                     SINPUT
   79 READ (5,80) MSDM(J),MSDN(J),(APSDM(I,J),I=1,3),                   SINPUT
     *            (APSDN(I,J),I=1,3),(ASD(I,J),I=1,5)                   SINPUT
   80 FORMAT(2I3,11F6.0)                                                SINPUT
      WRITE (6,81) UNITL                                                SINPUT
   81 FORMAT('0',5X,'SPRING  DAMPERS  FUNCTION  INPUT',82X,'CARDS D.8'//SINPUT
     *   18X,'COORDINATES OF ATTACHMENT POINTS (',A4,')'/               SINPUT
     *   5X,'SEGMENT',9X,'SEGMENT M',16X,'SEGMENT N',15X,               SINPUT
     *   'SPRING FORCE FUNCTION',12X,'DAMPING FORCE FUNCTION'/          AFREVS
     *   ' NO.  M    N',2(6X,'X',7X,'Y',7X,'Z',2X),7X,'DO',9X,'A1',11X, SINPUT
     *   'A2',13X,'B1',10X,'B2' // )                                    SINPUT
      DO  82  J=1,NSD                                                   SINPUT
   82 WRITE (6,83) J,MSDM(J),MSDN(J),(APSDM(I,J),I=1,3),                SINPUT
     *              (APSDN(I,J),I=1,3),(ASD(I,J),I=1,5)                 SINPUT
   83 FORMAT(I3,2I4,2(1X,3F8.2),F11.2,2F12.3,F15.3,F12.3)               SINPUT
C                                                                       SINPUT
C     CARDS D.9  FORCE AND/OR TORQUE FUNCTIONS.                         CHGIII
C                                                                       SINPUT
   90 NFVSEG(6)= NFORCE                                                 SINPUT
      IF  (NFORCE.LE.0)  GO TO 99                                       SINPUT
      WRITE  (6,91)                                                     SINPUT
   91 FORMAT ('0',6X,'FORCE AND/OR TORQUE FUNCTION INPUTS',78X,'CARDS D.CHGIII
     *9'//,    5X,'NO.', 5X,'SEG', 5X,'FCN', 13X,'X', 9X,'Y', 9X,'Z',   CHGIII
     *         13X,'YAW', 6X,'PITCH', 6X,'ROLL' //)                     SINPUT
      DO  95  J=1,NFORCE                                                SINPUT
      READ  (5,92)  NFVSEG(J),NFVNT(J),P1,P2                            SINPUT
   92 FORMAT (2I6,6F10.0)                                               SINPUT
      WRITE  (6,93)  J,NFVSEG(J),NFVNT(J),P1,P2                         SINPUT
   93 FORMAT (3I8,6X,3F10.3,6X,3F10.3)                                  SINPUT
      CALL DRCYPR (DE,P2,IDYPR)                                         SINPUT
      DO  94  I=1,3                                                     SINPUT
   94 QFU(I,J) = DE(1,I)                                                FIXSPT
   95 CALL CROSS (P1,QFU(1,J),QFV(1,J))                                 SINPUT
   99 RETURN                                                            SINPUT
```

END

SINPUT

```
      SUBROUTINE  SLPLOT  (X, NX, X0, XN, XL, XSIZE, XLAB, NXLB,        SLPLOT
     *                     Y, NY, Y0, YN, YL, YSIZE, YLAB, NYLB,        SLPLOT
     *                     NPTS, NYY, NDY, PLAB1, NPLB1, PLAB2, NPLB2)  SLPLOT
C                                                 REV III.2 08/08/84REVIII
C                                                                       SLPLOT
C     ARGUMENTS:                                                        SLPLOT
C        X(NPTS)      - ARRAY OF NPTS ABSCISSAS TO BE PLOTTED.          SLPLOT
C        Y(NDY,NYY)   - ARRAY OF NPTS*NYY ORDINATES TO BE PLOTTED.      SLPLOT
C        NX,NY        - POSITIVE - NO. OF LINEAR SUBDIVISIONS.          SLPLOT
C                       NEGATIVE - NO. OF LOGARITHMIC DECADES.          SLPLOT
C        X0,Y0        - AXES ORIGINS (POWER OF TEN IF NX,NY NEGATIVE).  SLPLOT
C        XN,YN        - AXES END VALUES (REQUIRED IF NX,NY POSITIVE).   SLPLOT
C        XL,YL        - LENGTH (INCHES) OF X,Y AXES.                    SLPLOT
C        XSIZE,YSIZE  - PAPER SIZE (INCHES) IN X,Y DIRECTIONS.          SLPLOT
C        XLAB,YLAB    - X,Y AXES LABELS (ALPHANUMERIC ARRAYS).          SLPLOT
C        NXLB,NYLB    - NO. OF CHARACTERS IN X,Y LABELS.                SLPLOT
C        NPTS         - NO. OF POINTS IN X ARRAY AND EACH Y ARRAY.      SLPLOT
C        NYY          - NO. OF Y ARRAYS TO BE PLOTTED VS. X ARRAY.      SLPLOT
C        NDY          - FIRST DIMENSION OF Y ARRAY IN CALLING ROUTINE.  SLPLOT
C                       (NDY MUST BE .GE. NPTS)                         SLPLOT
C        PLAB1,PLAB2  - 1ST & 2ND LINES OF PLOT ID LABELS (ALPHANUMERIC).SLPLOT
C        NPLB1,NPLB2  - NO. OF CHARACTERS IN PLOT ID LABELS.            SLPLOT
C                                                                       SLPLOT
C     NOTE: PLOTS WILL BE TRUNCATED AS FOLLOWS:                         SLPLOT
C      NX,NY POSITIVE - X0,Y0 .LE. X,Y .LE. XN,YN                       SLPLOT
C      NX,NY NEGATIVE - X0,Y0 .LE. X,Y .LE. XN*10**(-NX),Y0*10**(-NY)   SLPLOT
C                                                                       SLPLOT
      DIMENSION X(NPTS),Y(NDY,NYY)                                      80386
      CHARACTER*4 XLAB(1),YLAB(1),PLAB1(1),PLAB2(1)                     80386
C                                                                       SLPLOT
C     NOTE: THIS ROUTINE HAS BEEN WRITTEN FOR THE PLOTTING FACILITIES   SLPLOT
C     AT CALSPAN. THE FOLLOWING ITEMS ARE KNOWN TO BE CONTRARY TO THE   SLPLOT
C     NORMAL CALCOMP PROCEDURES AND SHOULD BE EXAMINED BY USERS AT OTHERSLPLOT
C     COMPUTER SYSTEMS AND CHANGES MADE ACCORDINGLY.                    SLPLOT
C                                                                       SLPLOT
C       1. AT CALSPAN THE PLOTTED CHARACTERS GENERATED BY SUBROUTINE    SLPLOT
C          SYMBOL HAVE A WIDTH OF 6/7 TIMES THE HEIGHT. FOR THE CALCOMP SLPLOT
C          ROUTINES THE WIDTH IS EQUAL TO THE HEIGHT. THE STATEMENT     SLPLOT
C          'WIDTHF = 6.0/7.0' SHOULD BE CHANGED TO 'WIDTHF = 1.0'.      SLPLOT
C                                                                       SLPLOT
C       2. THE ONLY INITIALIZATION REQUIRED AT CALSPAN IS THE STATEMENT SLPLOT
C          'CALL PLOT (0.0,0.0,0)' TO ESTABLISH A NEW PAGE, INCLUDING   SLPLOT
C          THE FIRST PAGE. THIS IS FOLLOWED BY 'CALL PLOT (X0,Y0,-3)' TOSLPLOT
C          SET THE PLOT ORIGIN ON THE PAGE. PROPER PLOT INITIALIZATION  SLPLOT
C          SHOULD BE DONE HERE AND IN SUBROUTINE POSTPR (AFTER STATEMENTSLPLOT
C          NO. 30) AS REQUIRED BY THE USER'S PLOTTING FACILITY.         SLPLOT
C                                                                       SLPLOT
C       3. THE STATEMENT 'CALL NEWPEN(2)' SHOULD BE EXAMINED OR DELETED.SLPLOT
C                                                                       SLPLOT
C       4. THE STATEMENT 'CALL EFPLOT' AFTER STATEMENT NO. 50 IN POSTPR SLPLOT
C          IS REQUIRED AT CALSPAN TO CLOSE OUT THE PLOT FILES. THIS     SLPLOT
C          SHOULD BE CHANGED TO CONFORM TO THE REQUIREMENTS OF THE      SLPLOT
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C          USER'S PLOTTING FACILITIES.                                  SLPLOT
C                                                                       SLPLOT
C       5. THE NECESSARY JOB CONTROL LANGUAGE FOR PLOTTING IS NECESSARY.SLPLOT
C                                                                       SLPLOT
C       6. THE ONLY CALCOMP ROUTINES NEEDED ARE SYMBOL, NUMBER AND PLOT.SLPLOT
C                                                                       SLPLOT
      LOGICAL NXPOS,NXNEG,NYPOS,NYNEG                                   SLPLOT
      DATA HN/0.07/, HL/0.105/                                          SLPLOT
      WIDTHF = 1.0                                                      REDIMN
      WN = WIDTHF*HN                                                    SLPLOT
      WL = WIDTHF*HL                                                    SLPLOT
C         **  PLOT PAGE INITIALIZATION  **                              SLPLOT
      CALL PLOT (0.0,0.0,-3)                                            CHANGE
      XP =  0.5*(XSIZE-(XL-0.5))                                        SLPLOT
      YP = 0.5*(YSIZE-(YL-1.0))                                         SLPLOT
      CALL PLOT (XP,YP,-3)                                              SLPLOT
      NXPOS = NX.GT.0                                                   SLPLOT
      NXNEG = NX.LT.0                                                   SLPLOT
      NYPOS = NY.GT.0                                                   SLPLOT
      NYNEG = NY.LT.0                                                   SLPLOT
C         **  PLOT AXES AND ID LABELS.  **                              SLPLOT
      XP = 0.0                                                          SLPLOT
      YP = 0.0                                                          SLPLOT
      IF  (.NOT.NXPOS)  GO TO 12                                        SLPLOT
C         **          LINEAR X AXIS        **                           SLPLOT
      CALL LINAXS (XP, YP, 0.0, NX, XL)                                 SLPLOT
      XB = XL/(XN-X0)                                                   SLPLOT
C         **    LINEAR X AXIS NUMERICS  **                              SLPLOT
      DX = XL/FLOAT(NX)                                                 SLPLOT
      EX = X0                                                           SLPLOT
      DD = (XN-X0)/FLOAT(NX)                                            SLPLOT
      ND = 0.99 - ALOG10(ABS(DD))                                       SLPLOT
      IF  (ND.LE.0)  ND = -1                                            SLPLOT
      IX = 0                                                            SLPLOT
      YC = YP - 2.0*HN                                                  SLPLOT
   11 AX = ABS(EX)                                                      SLPLOT
      NF = 0                                                            SLPLOT
      IF  (AX.GE.10.0)  NF = ALOG10(AX)                                 SLPLOT
      NS = 0                                                            SLPLOT
      IF  (EX.LT.0.0)   NS = 1                                          SLPLOT
      SP = NS+NF+2+ND                                                   SLPLOT
      XC = XP - 0.5*SP*WN                                               SLPLOT
      CALL NUMBER (XC, YC, HN, EX, 0.0, ND)                             SLPLOT
      XP = XP + DX                                                      SLPLOT
      EX = EX + DD                                                      SLPLOT
      IX = IX + 1                                                       SLPLOT
      IF  (ABS(EX).GT.ABS(0.1*DD))  GO TO 18                            SLPLOT
      IF  (IX.GT.NX)  GO TO 12                                          SLPLOT
      CALL PLOT (XP, YP+YL,3)                                           SLPLOT
      CALL PLOT (XP, YP   ,2)                                           SLPLOT
   18 IF  (IX.LE.NX)    GO TO 11                                        SLPLOT
   12 IF  (.NOT.NXNEG)  GO TO 14                                        SLPLOT
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C        **            LOG X AXIS         **                                   SLPLOT
      CALL LOGAXS (XP, YP, 0.0, -NX, XL)                                       SLPLOT
      XB = XL/ALOG(10.0**(-NX))                                                SLPLOT
      XA = -XB*ALOG(X0)                                                        SLPLOT
C        **      LOG X AXIS NUMERICS      **                                   SLPLOT
      DX = XL/FLOAT(-NX)                                                       SLPLOT
      EX = ALOG10(X0)                                                          SLPLOT
      IX = 0                                                                   SLPLOT
   13 CALL NUMBER (XP-1.0*WN, YP-2.5*HN, HN, 10.0, 0.0, -1)                    SLPLOT
      CALL NUMBER (XP+1.0*WN, YP-2.0*HN, HN,   EX, 0.0, -1)                    SLPLOT
      XP = XP + DX                                                             SLPLOT
      EX = EX + 1.0                                                            SLPLOT
      IX = IX - 1                                                              SLPLOT
      IF  (IX.GE.NX)   GO TO 13                                                SLPLOT
   14 IF  (NXLB.LE.0)  GO TO 15                                                SLPLOT
C        **          X AXIS LABEL         **                                   SLPLOT
      XPX = (XL-FLOAT(NXLB)*WL)/2.0                                            SLPLOT
      YPX = YP-4.0*HN-HL                                                       SLPLOT
      CALL SYMBOL(XPX, YPX, HL, XLAB,  0.0, NXLB)                              SLPLOT
   15 IF  (NPLB1.LE.0)  GO TO 16                                               SLPLOT
C        **    PLOT LABEL - 1ST LINE      **                                   SLPLOT
      XP1 = (XL-FLOAT(NPLB1)*WL)/2.0                                           SLPLOT
      YP1 = YP-4.0*HN-4.0*HL                                                   SLPLOT
      CALL SYMBOL (XP1, YP1, HL, PLAB1,  0.0, NPLB1)                           SLPLOT
   16 IF  (NPLB2.LE.0)  GO TO 20                                               SLPLOT
C        **    PLOT LABEL - 2ND LINE      **                                   SLPLOT
      XP2 = (XL-FLOAT(NPLB2)*WL)/2.0                                           SLPLOT
      YP2 = YP-4.0*HN-6.0*HL                                                   SLPLOT
      CALL SYMBOL (XP2, YP2, HL, PLAB2,  0.0, NPLB2)                           SLPLOT
   20 XP = 0.0                                                                 SLPLOT
C        **      COMPLETE AXIS GRID       **                                   SLPLOT
      IF  (NYPOS)  CALL LINAXS (XL, YP,   90.0,  NY,  YL)                      SLPLOT
      IF  (NYNEG)  CALL LOGAXS (XL, YP,   90.0, -NY,  YL)                      SLPLOT
      IF  (NXPOS)  CALL LINAXS (XL ,YL, 180.0,  NX,  XL)                       SLPLOT
      IF  (NXNEG)  CALL LOGAXS (XL ,YL, 180.0, -NX, -XL)                       SLPLOT
      IF  (.NOT.NYPOS)  GO TO 22                                               SLPLOT
C        **          LINEAR Y AXIS        **                                   SLPLOT
      CALL LINAXS (XP, YL, -90.0,  NY,  YL)                                    SLPLOT
      YB = YL/(YN-Y0)                                                          SLPLOT
C        **     LINEAR Y AXIS NUMERICS    **                                   SLPLOT
      DY = YL/FLOAT(NY)                                                        SLPLOT
      EY = Y0                                                                  SLPLOT
      DD = (YN-Y0)/FLOAT(NY)                                                   SLPLOT
      ND = 0.99 - ALOG10(ABS(DD))                                              SLPLOT
      IF  (ND.LE.0)  ND = -1                                                   SLPLOT
      IY = 0                                                                   SLPLOT
      XC = XP - 1.0*HN                                                         SLPLOT
   21 AY = ABS(EY)                                                             SLPLOT
      NF = 0                                                                   SLPLOT
      IF  (AY.GE.10.0)  NF = ALOG10(AY)                                        SLPLOT
      NS = 0                                                                   SLPLOT
      IF  (EY.LT.0.0)   NS = 1                                                 SLPLOT
```

```
      SP = NS+NF+2+ND                                                  SLPLOT
      YC = YP - 0.5*SP*WN                                              SLPLOT
      CALL NUMBER (XC, YC, HN, EY, 90.0, ND)                           SLPLOT
      YP = YP + DY                                                     SLPLOT
      EY = EY + DD                                                     SLPLOT
      IY = IY + 1                                                      SLPLOT
      IF  (ABS(EY).GT.ABS(0.1*DD))  GO TO 19                           SLPLOT
      IF  (IY.GT.NY)  GO TO 22                                         SLPLOT
      CALL PLOT (XP+XL, YP, 3)                                         SLPLOT
      CALL PLOT (XP    , YP, 2)                                        SLPLOT
   19 IF  (IY.LE.NY)    GO TO 21                                       SLPLOT
   22 IF  (.NOT.NYNEG)  GO TO 24                                       SLPLOT
C         **           LOG Y AXIS          **                          SLPLOT
      CALL LOGAXS (XP, YL, -90.0, -NY, -YL)                            SLPLOT
      YB = YL/ALOG(10.0**(-NY))                                        SLPLOT
      YA = -YB*ALOG(Y0)                                                SLPLOT
C         **       LOG Y AXIS NUMERICS     **                          SLPLOT
      DY = YL/FLOAT(-NY)                                               SLPLOT
      EY = ALOG10(Y0)                                                  SLPLOT
      IY = 0                                                           SLPLOT
   23 CALL NUMBER (XP-1.0*HN, YP-1.0*WN, HN, 10.0, 90.0, -1)           SLPLOT
      CALL NUMBER (XP-1.5*HN, YP+1.0*WN, HN,   EY, 90.0, -1)           SLPLOT
      YP = YP + DY                                                     SLPLOT
      EY = EY + 1.0                                                    SLPLOT
      IY = IY - 1                                                      SLPLOT
      IF  (IY.GE.NY)   GO TO 23                                        SLPLOT
   24 IF  (NYLB.LE.0)  GO TO 25                                        SLPLOT
C         **          Y AXIS LABEL         **                          SLPLOT
      XPY = XP-4.0*HN                                                  SLPLOT
      YPY = (YL-FLOAT(NYLB)*WL)/2.0                                    SLPLOT
      CALL SYMBOL(XPY, YPY, HL, YLAB, 90.0, NYLB)                      SLPLOT
   25 CONTINUE                                                         SLPLOT
C         **       PLOT DATA ARRAYS        **                          SLPLOT
      NSYM = 24                                                        SLPLOT
      IS = NPTS/NSYM                                                   SLPLOT
      IF (IS.EQ.0) IS = 1                                              VARTTH
      XOMIN = X0/1000.0                                                SLPLOT
      YOMIN = Y0/1000.0                                                SLPLOT
      DO  40  J=1,NYY                                                  SLPLOT
      IPEN = 3                                                         SLPLOT
      DO  39  I=1,NPTS                                                 SLPLOT
      X1 = X2                                                          SLPLOT
      Y1 = Y2                                                          SLPLOT
      IF  (NXPOS)  X2 = XB*(X(I)   -X0)                                SLPLOT
      IF  (NYPOS)  Y2 = YB*(Y(I,J)-Y0)                                 SLPLOT
      IF  (NXNEG)  X2 = XA + XB*ALOG(AMAX1(X(I)   ,XOMIN))             SLPLOT
      IF  (NYNEG)  Y2 = YA + YB*ALOG(AMAX1(Y(I,J),YOMIN,))             SLPLOT
      IF  (Y2.LT.0.0 .OR. Y2.GT.YL)  GO TO 33                          SLPLOT
      IF  (X2.LT.0.0 .OR. X2.GT.XL)  GO TO 33                          SLPLOT
      IF  (IPEN.EQ.3)  GO TO 33                                        SLPLOT
      CALL PLOT (X2,Y2,IPEN)                                           SLPLOT
C         **       PLOT NYSM SYMBOLS       **                          SLPLOT
```

```
      IF  (NYY.EQ.1 .OR. MOD(I,IS).NE.0)  GO TO 39                        SLPLOT
      IF  (MOD((I/IS)-1,NYY)+1.EQ.J)                                      80386
     *    CALL SYMBOL (X2,Y2,0.14,CHAR(J),0.0,-2)                         80386
      GO TO 39                                                            SLPLOT
   33 IF  (I.EQ.1)     GO TO 39                                           SLPLOT
      DX   = X2 - X1                                                      SLPLOT
      IF  (DX.NE.0.0)  GO TO 34                                           SLPLOT
      AX0 = 1.0                                                           SLPLOT
      AXL = 0.0                                                           SLPLOT
      IF  (X1.GE.0.0)  AX0 = 0.0                                          SLPLOT
      IF  (X1.LE.XL )  AXL = 1.0                                          SLPLOT
      GO TO 35                                                            SLPLOT
   34 AX0 =      -X1 /DX                                                  SLPLOT
      AXL = (XL-X1)/DX                                                    SLPLOT
   35 AX1 = AMIN1(AX0,AXL)                                                SLPLOT
      AX2 = AMAX1(AX0,AXL)                                                SLPLOT
      DY   = Y2 - Y1                                                      SLPLOT
      IF  (DY.NE.0.0)  GO TO 36                                           SLPLOT
      AY0 = 1.0                                                           SLPLOT
      AYL = 0.0                                                           SLPLOT
      IF  (Y1.GE.0.0)  AY0 = 0.0                                          SLPLOT
      IF  (Y1.LE.YL )  AYL = 1.0                                          SLPLOT
      GO TO 37                                                            SLPLOT
   36 AY0 =      -Y1 /DY                                                  SLPLOT
      AYL = (YL-Y1)/DY                                                    SLPLOT
   37 AY1 = AMIN1(AY0,AYL)                                                SLPLOT
      AY2 = AMAX1(AY0,AYL)                                                SLPLOT
      A1   = AMAX1(AX1,AY1,0.0)                                           SLPLOT
      A2   = AMIN1(AX2,AY2,1.0)                                           SLPLOT
      IF  (A1.GE.A2 )  GO TO 39                                           SLPLOT
      XP = X1 + A1*DX                                                     SLPLOT
      YP = Y1 + A1*DY                                                     SLPLOT
      CALL PLOT(XP,YP,IPEN)                                               SLPLOT
      IPEN = 2                                                            SLPLOT
      XP = X1 + A2*DX                                                     SLPLOT
      YP = Y1 + A2*DY                                                     SLPLOT
      CALL PLOT(XP,YP,IPEN)                                               SLPLOT
      IF  (A2.NE.1.0)  IPEN = 3                                           SLPLOT
   39 CONTINUE                                                            SLPLOT
   40 CONTINUE                                                            SLPLOT
      RETURN                                                              SLPLOT
      END                                                                 SLPLOT
```

```
      SUBROUTINE SOLVA(R,AA11,AA22,AA12)                                SOLVA
C                                                    REV III.2 08/08/84REVIII
      IMPLICIT REAL*8 (A-H,O-Z)                                         SOLVA
      DIMENSION R(2,3)                                                  SOLVA
      A11=R(1,1)**2                                                     SOLVA
      A12=2.0*R(2,1)*R(1,1)                                             SOLVA
      A13=R(2,1)**2                                                     SOLVA
      A21=R(1,2)**2                                                     SOLVA
      A22=2.0*R(2,2)*R(1,2)                                             SOLVA
      A23=R(2,2)**2                                                     SOLVA
      A31=R(1,3)**2                                                     SOLVA
      A32=2.0*R(2,3)*R(1,3)                                             SOLVA
      A33=R(2,3)**2                                                     SOLVA
      DEL=A11*(A22*A33-A23*A32)-A12*(A21*A33-A23*A31)+                  SOLVA
     *    A13*(A21*A32-A22*A31)                                         SOLVA
      AA11=((A22-A12)*(A33-A23)-(A23-A13)*(A32-A22))/DEL                SOLVA
      AA12=((A23-A13)*(A31-A21)-(A21-A11)*(A33-A23))/DEL                SOLVA
      AA22=((A21-A11)*(A32-A22)-(A22-A12)*(A31-A21))/DEL                SOLVA
      RETURN                                                            SOLVA
      END                                                               SOLVA
```

```
      SUBROUTINE SOLVR(A1,A2,A3,A4,A5,A6,A7,A8,P,RX,RZ)              SOLVR
C                                                   REV III.2 08/08/84REVIII
      IMPLICIT REAL*8 (A-H,O-Z)                                      SOLVR
C                                                                    SOLVR
C        ****************************************                    SOLVR
C                                                                    SOLVR
C        THIS SUBROUTINE WILL SOLVE A SET OF SIMULTANEOUS EQUATIONS  SOLVR
C       TO FIND COMPONETS OF VECTOR R THAT SATISFY THE PROPERTIES NEEDEDSOLVR
C      TO DETURMINE THE EQUATION OF THE PROJECTED ELLIPSE.           SOLVR
C                                                                    SOLVR
C            SEE WRITEUP.                                            SOLVR
C                                                                    SOLVR
C        ****************************************                    SOLVR
      DIMENSION P(3)                                                 SOLVR
      B=A1*P(1)+A2*P(2)+A3*P(3)                                      SOLVR
      D=A4*P(1)+A5*P(2)+A6*P(3)                                      SOLVR
      T1=A7*(D/B)**2+A6-2.0*A8*D/B                                   SOLVR
      T2=2.0*A7*D/(B)**2-2.0*A8/B                                    SOLVR
      T3=A7*(1/B)**2-1                                               SOLVR
      RZ=(-T2+DSQRT(T2**2-4.0*T1*T3))/(2.0*T1)                       SOLVR
      RX=-D*RZ/B-1.0/B                                               SOLVR
      RETURN                                                         SOLVR
      END                                                            SOLVR
```

```
      SUBROUTINE SPDAMP                                                 SPDAMP
C                                                    REV IV   07/24/86SLIP
C     COMPUTES THE SPRING AND VISCOUS FORCE OF A SPRING DAMPER BETWEEN  SPDAMP
C     SPECIFIED POINTS ON SELECTED SEGMENTS AND ADDS THE RESULTING      SPDAMP
C     FORCE AND TORQUE TO THE U1 AND U2 ARRAYS.                         SPDAMP
C                                                                       SPDAMP
      IMPLICIT REAL*8(A-H,O-Z)                                          SPDAMP
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           SPDAMP
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),SPDAMP
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       SPDAMP
      COMMON/DAMPER/ APSDM(3,20),APSDN(3,20),ASD(5,20),MSDM(20),MSDN(20)SPDAMP
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)BUTLER2
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         SPDAMP
      COMMON/TEMPVS/DELM(3),DELN(3),DD(3),DEL,T1(3),T2(3),T3(3),T4(3),  SPDAMP
     *              DUNIT(3),DV(3),DMV,DD0,FS,FD,TOTF(3),               SPDAMP
     *              T5(3),T6(3),T7(3),T8(3),DMMY(35066)                 80386
      CALL ELTIME(1,32)                                                 SPDAMP
      NBSF0 = NBSF                                                      SPDAMP
      DO 90 I=1,NSD                                                     SPDAMP
      M = MSDM(I)                                                       SPDAMP
      N = MSDN(I)                                                       SPDAMP
C                                                                       SPDAMP
C     COMPUTE VECTOR AND ITS MAGNITUDE BETWEEN THE SPECIFIED POINTS.    SPDAMP
C                                                                       SPDAMP
      CALL DOT31 (D(1,1,M),APSDM(1,I),DELM)                             SPDAMP
      CALL DOT31 (D(1,1,N),APSDN(1,I),DELN)                             SPDAMP
      DEL = 0.0                                                         SPDAMP
      DO 10 K=1,3                                                       SPDAMP
      DD(K) = SEGLP(K,M)+DELM(K)-SEGLP(K,N)-DELN(K)                     SPDAMP
   10 DEL = DEL+DD(K)**2                                                SPDAMP
      IF  (DEL.LE.0.0)  GO TO 90                                        SPDAMP
      DEL = DSQRT(DEL)                                                  SPDAMP
C                                                                       SPDAMP
C     COMPUTE RELATIVE VELOCITY AND ITS COMPONENT ON VECTOR LINE.       SPDAMP
C                                                                       SPDAMP
      CALL CROSS(WMEG(1,M),APSDM(1,I),T1)                               SPDAMP
      CALL CROSS(WMEG(1,N),APSDN(1,I),T2)                               SPDAMP
      CALL DOT31 (D(1,1,M),T1,T3)                                       SPDAMP
      CALL DOT31 (D(1,1,N),T2,T4)                                       SPDAMP
      DO 20 K=1,3                                                       SPDAMP
      DUNIT(K) = DD(K)/DEL                                              SPDAMP
   20 DV(K) = SEGLV(K,M)+T3(K)-SEGLV(K,N)-T4(K)                         SPDAMP
      DMV = DUNIT(1)*DV(1)+DUNIT(2)*DV(2)+DUNIT(3)*DV(3)                SPDAMP
C                                                                       SPDAMP
C     COMPUTE SPRING AND VISCOUS FORCE AND THE COMPONENTS               SPDAMP
C     ALONG THE UNIT VECTOR                                             SPDAMP
C                                                                       SPDAMP
      FS = 0.0                                                          SPDAMP
      FD = 0.0                                                          SPDAMP
      IF  (ASD(1,I).LT.0.0)  GO TO 21                                   SLIP
```

```
      DDO = DEL-ASD(1,I)                                                  SPDAMP
      IF  (DDO.LE.0.0 .AND. ASD(2,I).LE.0.0)  GO TO 41                    SPDAMP
      FS = DDO*(DABS(ASD(2,I)) + DABS(DDO)*ASD(3,I))                      SPDAMP
      FD = DMV*(ASD(4,I)+DABS(DMV)*ASD(5,I))                              SPDAMP
      GO TO 29                                                            SPDAMP
   21 DDO = DEL+ASD(1,I)                                                  SPDAMP
      JF1 = ASD(2,I)                                                      SPDAMP
      IF  (JF1.EQ.0)  GO TO 22                                            SPDAMP
      JF2 = NTI(JF1)                                                      SPDAMP
      IF  (DDO.GT.0.0 .OR. ASD(3,I).EQ.0.0)  FS = EVALFD(DDO,JF2,1)       SPDAMP
   22 JF3 = ASD(4,I)                                                      SPDAMP
      IF  (JF3.EQ.0)  GO TO 29                                            SPDAMP
      JF4 = NTI(JF3)                                                      SPDAMP
      IF  (DDO.GT.0.0 .OR. ASD(3,I).EQ.0.0)  FD = EVALFD(DMV,JF4,1)       SLIP
   29 DO 30 K=1,3                                                         SPDAMP
   30 TOTF(K) = (FS+FD)*DUNIT(K)                                          SPDAMP
C                                                                         SPDAMP
C     AND ADD THE RESULTING FORCE AND TORQUE TO THE U1 AND U2 ARRAYS.     SPDAMP
C                                                                         SPDAMP
      CALL MAT31(D(1,1,M),TOTF,T5)                                        SPDAMP
      CALL MAT31(D(1,1,N),TOTF,T6)                                        SPDAMP
      CALL CROSS(APSDM(1,I),T5,T7)                                        SPDAMP
      CALL CROSS(APSDN(1,I),T6,T8)                                        SPDAMP
      DO 40 K=1,3                                                         SPDAMP
      U1(K,M) = U1(K,M) - TOTF(K)                                         SPDAMP
      U1(K,N) = U1(K,N) + TOTF(K)                                         SPDAMP
      U2(K,M) = U2(K,M) - T7(K)                                           SPDAMP
   40 U2(K,N) = U2(K,N) + T8(K)                                           SPDAMP
   41 IBSF = 3-2*MOD(I,2)                                                 SPDAMP
      NBSF - NBSFO + (I+1)/2                                              SPDAMP
      BSF(IBSF  ,NBSF) = DEL                                              SPDAMP
      BSF(IBSF+1,NBSF) = FD + FS                                          SPDAMP
   90 CONTINUE                                                            SPDAMP
      CALL ELTIME(2,32)                                                   SPDAMP
      RETURN                                                              SPDAMP
      END                                                                 SPDAMP
```

```
      SUBROUTINE SPLINE (X,Y,F,N,L)                                     SPLINE
C                                                      REV 19    05/14/79SPLINE
C                                                                       SPLINE
C     ROUTINE TO FIT A SET OF POLYNOMIALS OF DEGREE L                   SPLINE
C     TO A SET OF GIVEN DATA POINTS (X(I),Y(I),I=1,N)                   SPLINE
C                                                                       SPLINE
C     FUNCTION IS OF FORM:                                              SPLINE
C                                                                       SPLINE
C       Y = F(2,K) + F(3,K)*DX + F(4,K)*DX**2 + F(5,K)*DX**3            SPLINE
C                                                                       SPLINE
C       WHERE: DX = XX - F(1,K)                                         SPLINE
C              F(1,K) .LE. XX .LT. F(1,K+1)   ;  (SETS K)               SPLINE
C              IF  (XX.GT.F(1,N))  ;  USE K=N, CONSTANT FIT TO Y(N)     SPLINE
C              IF  (XX.LT.F(1,1))  ;  EXTRAPOLATED FIT FOR K=1          SPLINE
C                                                                       SPLINE
C                 F(1,I) = X(I) ,                 I=1,N                 SPLINE
C                 F(2,I) = Y(I) ,                 I=1,N                 SPLINE
C                                                                       SPLINE
C      DEGREE L                                          CONTINUITY     SPLINE
C             0   F(3,I) = F(4,I) = F(5,I) = 0 , I=1,N      NONE        SPLINE
C             1   F(4,I) = F(5,I) = 0  ,         I=1,N      Y           SPLINE
C             2   F(5,I) = 0 ,                   I=1,N      Y,Y'        SPLINE
C             3   CUBIC SPLINE                              Y,Y',Y''    SPLINE
C                                                                       SPLINE
C                 F(K,N)=0 FOR K=3,5 IN ALL CASES                       SPLINE
C                                                                       SPLINE
C     FOR L=2 AND L=3 THE CHANGES IN THE L'TH DERIVATIVES ARE MINIMIZED SPLINE
C                                                                       SPLINE
C     SPECIAL CASES:                                                    SPLINE
C         N=1 ;     TREATED AS L=0                                      SPLINE
C         N=2 ;     TREATED AS L=MIN(L,1)                               SPLINE
C         L<0 ;     TREATED AS L=0                                      SPLINE
C         L>3 ;     TREATED AS L=3                                      SPLINE
C                                                                       SPLINE
C     STORAGE REQUIRED  X(N),Y(N),F(5,N); SET BY CALLING PROGRAM        SPLINE
C                                                                       SPLINE
C     USAGE:                                                            SPLINE
C       ALL COMPUTATIONS AND REAL VARIABLES ARE DOUBLE PRECISION        SPLINE
C       GIVEN:  L,N, (X(I),Y(I),I=1,N)                                  SPLINE
C       CALL SPLINE (X,Y,F,N,L)         ; SETS F                        SPLINE
C                                                                       SPLINE
CC                                                                      SPLINE
CC      TO EVALUATE FUNCTION AND DERIVATIVES AT POINT XX                SPLINE
CC                                                                      SPLINE
C           DO  10  K=1,N                                               SPLINE
C           IF (K.EQ.N)  GO TO 11                                       SPLINE
C           IF (XX.LT.F(1,K+1)) GO TO 11                                SPLINE
C       10  CONTINUE                                                    SPLINE
C       11  DX = XX - F(1,K)                                            SPLINE
C           YY = F(2,K) + DX*(F(3,K)+DX*(F(4,K)+DX*F(5,K)))             SPLINE
C           YD = F(3,K) + DX*(2.0*F(4,K)+3.0*DX*F(5,K))                 SPLINE
C           YDD = 2.0*F(4,K) + 6.0*DX*F(5,K)                            SPLINE
```

```
C           YDDD = 6.0*F(5,K)                                     SPLINE
C           YDDDD = 0.0                                           SPLINE
CC                                                                SPLINE
CC        FUNCTIONAL VALUE IN YY, DERIVATIVES IN YD'S             SPLINE
CC        REPEAT FOR NEXT VALUE OF XX                             SPLINE
C                                                                 SPLINE
C      AUTHOR: DR. JOHN T. FLECK                                  SPLINE
C                                                                 SPLINE
       IMPLICIT REAL*8 (A-H,O-Z)                                  SPLINE
       DIMENSION X(N),Y(N),F(5,N),C(2,3)                          SPLINE
       DO  20  I=1,N                                              SPLINE
       F(1,I) = X(I)                                              SPLINE
       DO  10  K=2,5                                              SPLINE
   10  F(K,I) = 0.0                                               SPLINE
       IF  (L.LT.3)  F(2,I) = Y(I)                                SPLINE
   20  IF  (L.GT.0 .AND. I.LT.N)  F(3,I) = (Y(I+1)-Y(I))/(X(I+1)-X(I))  SPLINE
       IF  (L.LT.2 .OR.  N.LT.3)  GO TO 99                        SPLINE
       IF  (L.GE.3)  GO TO 50                                     SPLINE
       D1 = X(2) - X(1)                                           SPLINE
       SS = 0.0                                                   SPLINE
       DS = 0.0                                                   SPLINE
       DO  30  I=3,N                                              SPLINE
       F(4,I-1) = F(3,I-1) - F(3,I-2) - F(4,I-2)                  SPLINE
       DX1 = X(I) - X(I-1)                                        SPLINE
       DX2 = X(I-1) - X(I-2)                                      SPLINE
       DD = D1/DX1 + D1/DX2                                       SPLINE
       SS = SS + DD*DD                                            SPLINE
       DS = DS + DD*(F(4,I-1)/DX1 - F(4,I-2)/DX2)                 SPLINE
   30  D1 = -D1                                                   SPLINE
       F(4,1) = DS/SS                                             SPLINE
       DX = (X(2)-X(1))*F(4,1)                                    SPLINE
       F(3,1) = F(3,1) - DX                                       SPLINE
       DO  40  I=3,N                                              SPLINE
       XX = F(4,I-1) - DX                                         SPLINE
       F(3,I-1) = F(3,I-1) - XX                                   SPLINE
       F(4,I-1) = XX/(X(I)-X(I-1))                                SPLINE
   40  DX = -DX                                                   SPLINE
       GO TO 99                                                   SPLINE
C                                                                 SPLINE
C      CUBIC SPLINE                                               SPLINE
C                                                                 SPLINE
   50  DO  51  I=2,N                                              SPLINE
       IF  (I.EQ.N)  GO TO 51                                     SPLINE
       F(4,I) = 3.0*(F(3,I)-F(3,I-1))                             SPLINE
       F(5,I) = 2.0*(X(I+1)-X(I-1))                               SPLINE
   51  F(3,I-1) = 0.0                                             SPLINE
       F(2,N) = -1.0                                              SPLINE
       F(3,1) = -1.0                                              SPLINE
       DO  60  I=3,N                                              SPLINE
       DX = X(I-1) - X(I-2)                                       SPLINE
       IF  (I.GT.3)  DX = DX/F(5,I-2)                             SPLINE
       DO  60  K=3,5                                              SPLINE
```

```
60  F(K,I-1) = F(K,I-1)- F(K,I-2)*DX**((K-1)/2)                      SPLINE
    DO  70  I=3,N                                                    SPLINE
    NI = N-I                                                         SPLINE
    DX = X(NI+3) - X(NI+2)                                           SPLINE
    DO  70  K=2,4                                                    SPLINE
70  F(K,NI+2) = (F(K,NI+2) - DX*F(K,NI+3))/F(5,NI+2)                 SPLINE
    DO  71  J=1,2                                                    SPLINE
    DO  71  K=J,3                                                    SPLINE
    C(J,K) = 0.0                                                     SPLINE
    DO  71  I=3,N                                                    SPLINE
    DX1 = X(I) - X(I-1)                                              SPLINE
    DX2 = X(I-1) - X(I-2)                                            SPLINE
71  C(J,K) = C(J,K) + (  (F(J+1,I  )-F(J+1,I-1))/DX1                 SPLINE
   *                   - (F(J+1,I-1)-F(J+1,I-2))/DX2)                SPLINE
   *                * (  (F(K+1,I  )-F(K+1,I-1))/DX1                 SPLINE
   *                   - (F(K+1,I-1)-F(K+1,I-2))/DX2)                SPLINE
    DEN    =  C(1,1)*C(2,2) - C(1,2)*C(1,2)                          SPLINE
    F(4,1) = (C(1,1)*C(2,3) - C(1,2)*C(1,3))/DEN                     SPLINE
    F(4,N) = (C(2,2)*C(1,3) - C(1,2)*C(2,3))/DEN                     SPLINE
    DO  72  I=3,N                                                    SPLINE
72  F(4,I-1) = F(4,I-1) - F(4,1)*F(3,I-1) - F(4,N)*F(2,I-1)          SPLINE
    D1 = X(2) - X(1)                                                 SPLINE
    F(3,1) = (Y(2)-Y(1))/D1 - (2.0*F(4,1)+F(4,2))*D1/3.0             SPLINE
    F(2,1) = Y(1)                                                    SPLINE
    DO  80  I=2,N                                                    SPLINE
    F(2,I) = Y(I)                                                    SPLINE
    DX = X(I) - X(I-1)                                               SPLINE
    IF  (I.LT.N)  F(3,I) = F(3,I-1) + (F(4,I)+F(4,I-1))*DX           SPLINE
80  F(5,I-1) = (F(4,I)-F(4,I-1))/(3.0*DX)                            SPLINE
    F(4,N) = 0.0                                                     SPLINE
99  RETURN                                                           SPLINE
    END                                                              SPLINE
```

```
      DOUBLE PRECISION FUNCTION SPRNGF(T,D,ZD,SPR,JSTOP)                SPRNGF
C                                                 REV IV    07/23/86TWOPI
C     COMPUTES NONLINEAR SPRING TORQUE FOR JOINTS AS A FUNCTION OF ANGLESPRNGF
C     ACTUALLY ROUTINE RETURNS TORQUE/ABS(SIN THETA)                    SPRNGF
C                                                                       SPRNGF
C     ARGUMENTS:                                                        SPRNGF
C          T     : COS THETA WHERE THETA IS ANGLE OF JOINT (0<THETA<PI) SPRNGF
C          D     : ABS(SIN THETA)                                       SPRNGF
C          ZD    : -THETA DOT * SIN THETA                               SPRNGF
C          SPR   : ARRAY OF 5 VALUES DESCRIBING FUNCTION EVALUATION     SPRNGF
C          JSTOP : INDICATOR TO BE SET TO ONE IF JOINT IS IN STOP       SPRNGF
C                                                                       SPRNGF
      IMPLICIT REAL*8 (A-H,O-Z)                                         SPRNGF
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         SPRNGF
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      DIMENSION SPR(5)                                                  SPRNGF
C                                                                       SPRNGF
C      RESET T=1 IF T>1 (HAD & HBD IN VISPR)                            SPRNGF
C                                                                       SPRNGF
      IF (T.GT.1.0) T = 1.0                                             SPRNGF
      IF (T.LT.-1.0) T = -1.0                                           SPRNGF
      Z = DACOS(T)                                                      SPRNGF
      U = EPS(1)*D                                                      SPRNGF
      Q = 0.0                                                           SPRNGF
      IF (D.NE.0.0) Q = -ZD/U                                           SPRNGF
      IF (Q.GT.1.0) Q = 1.0                                             SPRNGF
      IF (Q.LT.-1.0) Q = -1.0                                           SPRNGF
      X = 0.5*(1.0+SPR(4) + Q*(1.0-SPR(4)) )                            SPRNGF
      Y = 0.0                                                           SPRNGF
      IF (D.NE.0.0) Y = Z/D                                             SPRNGF
      Q = 1.0                                                           SPRNGF
      IF (DABS(Z).LT.EPS(4)) Y = DSIGN(Q,Z)                             SPRNGF
      SPRNGF = Y*SPR(1)                                                 SPRNGF
      JSTOP = 0                                                         SPRNGF
      IF (SPR(5).GT.0.0) GO TO 10                                       SPRNGF
      SPRNGF = X*SPRNGF                                                 SPRNGF
      GO TO 11                                                          SPRNGF
   10 IF (Z.LT.SPR(5)) GO TO 11                                         SPRNGF
      JSTOP = 1                                                         SPRNGF
      Z = Z-SPR(5)                                                      SPRNGF
      SPRNGF = SPRNGF + X/D*(SPR(2)+Z*SPR(3))*Z**2                      SPRNGF
   11 CONTINUE                                                          SPRNGF
      RETURN                                                            SPRNGF
      END                                                               SPRNGF
```

```
      SUBROUTINE TRIGFS                                                 TRIGFS
C                                                   REV 19     08/05/78TRIGFS
      IMPLICIT REAL*8 (A-H,O-Z)                                         TRIGFS
      COMMON/CDINT/ UU(4),GH(3,4),                                      TRIGFS
     *              E(3,240), F(5,240),GG(5,240),Y(5,240),U(5,240),     TRIGFS
     *              H,HPRINT,HS,TPRINT,TSTART,ICNT,IDBL,IFLAG,IDMMY     80386
      BETA = 0.0                                                        TRIGFS
      IF (HS.NE.0.0) BETA = (H/HS)**2                                   TRIGFS
      R1 = HS/H                                                         TRIGFS
      R2 = 1.0+BETA*R1                                                  TRIGFS
      GH(3,1) = 2.0/(H*R2)                                              TRIGFS
      GH(2,1) = GH(3,1)*(BETA-1.0)                                      TRIGFS
      GH(1,1) = GH(3,1)* BETA                                           TRIGFS
      GH(1,2) = 4.0*BETA/(R2*H**2)                                      TRIGFS
      GH(3,2) = GH(1,2)* R1                                             TRIGFS
      GH(2,2) = GH(1,2)*(R1+1.0)                                        TRIGFS
      GH(3,3) = 1.0/H                                                   TRIGFS
      GH(2,3) = 4.0*GH(3,3)                                             TRIGFS
      GH(1,3) = 3.0*GH(3,3)                                             TRIGFS
      GH(3,4) = 2.0/H**2                                                TRIGFS
      GH(2,4) = 2.0*GH(3,4)                                             TRIGFS
      GH(1,4) =     GH(3,4)                                             TRIGFS
      UU(1) = 2.0/H                                                     TRIGFS
      UU(2) = 0.0                                                       TRIGFS
      UU(3) = 0.5*H                                                     TRIGFS
      UU(4) = 0.25*H**2                                                 TRIGFS
      IF  (HS.EQ.0.0)  GO TO 99                                         TRIGFS
      UU(1) = BETA*(4.25+2.25/R1)                                       TRIGFS
      UU(2) = BETA*(2.25+1.25/R1)/R1                                    TRIGFS
      UAU   = 1.0+UU(1)+UU(2)                                           TRIGFS
      UU(1) = 2.0*UU(1)/(UAU*H)                                         TRIGFS
      UU(2) = 4.0*UU(2)/(UAU*H**2)                                      TRIGFS
   99 RETURN                                                            TRIGFS
      END                                                               TRIGFS
```

```
      SUBROUTINE UNIT1(IND)                                              UNIT1
C                                                   REV IV    02/20/87HYPER
C     THIS SUBROUTINE REPLACES THE PROGRAM CODE THAT PREVIOUSLY WAS     UNIT1
C     NEAR THE END OF THE MAIN PROGRAM TO WRITE ON UNIT 1 THAT DATA     UNIT1
C     USED FOR VARIOUS PLOTTING PROGRAMS (E.G. BUBBLE MAN PLOT).        UNIT1
C                                                                       UNIT1
C     THIS SUBROUTINE IS WRITTEN TO GENERATE UNIT 1 IN SUCH A MANNER    UNIT1
C     TO BE COMPATIBLE WITH THE INPUT REQUIREMENTS FOR THE AAMRL VIEW   UNIT1
C     PROGRAM THAT IS NOW BEING DISTRIBUTED ON THE CVS PROGRAM TAPES.   UNIT1
C                                                                       UNIT1
C     ARGUMENTS:                                                        UNIT1
C          IND = 0: CALL IS FROM THE MAIN PROGRAM                       UNIT1
C              # 0: CALL IS FROM SUBROUTINE EQUILB                      UNIT1
C                                                                       UNIT1
      IMPLICIT REAL*8 (A-H,O-Z)                                         UNIT1
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           UNIT1
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),UNIT1
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       UNIT1
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)           EDGE
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6), UNIT1
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), UNIT1
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               UNIT1
      COMMON/RSAVE/  XSG(3,20,3),DPMI(3,3,30),LPMI(30),                 UNIT1
     *               NSG(9),MSG(20,9),MCG,MCGIN(24,5),KREF(20,9)        TTHKREF
      COMMON/TEMPVS/ XD(3,3,30),XSEGLP(3,30),XPL(17,30),XBD(24,40),     UNIT1
     *               T1(3),T3(3,3),DMMY(34186)                          80386
      REAL XTIME,XD,XSEGLP,XPL,XBD                                      UNIT1
      DATA IFIRST/0/                                                    UNIT1
      IF  (NPRT(1).EQ.0)  GO TO 99                                      UNIT1
      IF  (IFIRST.NE.0)  GO TO 20                                       UNIT1
      IFIRST = 1                                                        UNIT1
C                                                                       UNIT1
C     FIRST TIME IN ROUTINE, WRITE STATIC DATA ON OUTPUT UNIT 1.        UNIT1
C     DATA MUST BE CONVERTED TO SINGLE PRECISION FOR VIEW PROGRAM.      UNIT1
C                                                                       UNIT1
      DO  11  J=1,30                                                    UNIT1
      DO 11 I=1,17                                                      FIXWBS
   11 XPL(I,J) = PL(I,J)                                                FIXWBS
      DO  12  J=1,40                                                    UNIT1
      K = 1                                                             HYPER
      IF (BD(1,J).LT.0.0) K = 2                                         HYPER
      DO  12  I=1,24                                                    UNIT1
      XBD(I,J) = BD(K,J)                                                HYPER
   12 K = K + 1                                                         HYPER
      WRITE (1) NSEG,NPL,XPL,XBD,MPL                                    UNIT1
      GOTO 99                                                           EDGE
C                                                                       UNIT1
C     WRITE TIME POINT DATA ON OUTPUT UNIT 1.                           UNIT1
C     DATA MUST BE CONVERTED TO SINGLE PRECISION FOR VIEW PROGRAM.      UNIT1
C                                                                       UNIT1
   20 XTIME = TIME                                                      UNIT1
```

```
      DO  22  K=1,30                                          UNIT1
      DO  22  J=1,3                                           UNIT1
      DO  21  I=1,3                                           UNIT1
   21 XD(I,J,K) = D(I,J,K)                                    UNIT1
   22 XSEGLP(J,K) = SEGLP(J,K)                                UNIT1
      DO  25  K=1,NSEG                                        UNIT1
      IF  (LPMI(K).EQ.0)  GO TO 25                            UNIT1
      CALL DOT33 (DPMI(1,1,K),D(1,1,K),T3)                    UNIT1
      DO  24  I=1,3                                           UNIT1
      DO  24  J=1,3                                           UNIT1
   24 XD(I,J,K) = T3(I,J)                                     UNIT1
   25 CONTINUE                                                UNIT1
      WRITE (1) XTIME,XSEGLP,XD                               UNIT1
   99 RETURN                                                  UNIT1
      END                                                     UNIT1
```

```
      SUBROUTINE UPDATE(I)                                              UPDATE
C                                                    REV IV   07/24/86SLIP
C     CALLED BY SUBROUTINE DINT                                         UPDATE
C                                                                       UPDATE
C       (I=1)  AT THE START OF A NEW STEP TO SETUP ANY NEW CONDITIONS   UPDATE
C              TO BE VALID FOR ENTIRE INTEGRATION STEP                  UPDATE
C                A. UPDATE FORCE DEFLECTION FUNCTIONS(SUBROUTINE UPDFDC)UPDATE
C                B. TEST FOR LOCKED JOINTS                              UPDATE
C       NOTE: ARGUMENT I WILL BE SET TO -1 TO RESET INTEGRATOR.         UPDATE
C                                                                       UPDATE
C       (I=2)  AT THE END OF EACH SUCCESSFUL INTEGRATION STEP TO        UPDATE
C              COMPLETE CALCULATIONS FOR OUTPUT (SUBROUTINE AIRBG3).    UPDATE
C                                                                       UPDATE
      IMPLICIT REAL*8(A-H,O-Z)                                          UPDATE
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           UPDATE
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),UPDATE
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       UPDATE
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     UPDATE
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    UPDATE
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),UPDATE
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                LIP
      COMMON/JBARTZ/ MNPL(   30),MNBLT(   8),MNSEG(   30),MNBAG(    6)     ATE
     *               MPL(3,5,30),MBLT(3,5,8),MSEG(3,5,30),MBAG(3,10,6), UPDATE
     *               NTPL( 5,30),NTBLT( 5,8),NTSEG( 5,30)               UPDATE
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)UPDATE
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         UPDATE
      COMMON/CSTRNT/ A13(3,3,24),A23(3,3,24),B31(3,3,24),B32(3,3,24),   UPDATE
     *               HHT(3,3,12),RK1(3,12),RK2(3,12),QQ(3,12),TQQ(3,12),UPDATE
     *               RQQ(3,12),HQQ(3,12),SQQ(12),CFQQ(12),              UPDATE
     *               KQ1(12),KQ2(12),KQTYPE(12)                         UPDATE
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           UPDATE
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      COMMON/HRNESS/ BAR(15,100),BB(100),BBDOT(100),PLOSS(2,100),       UPDATE
     *               XLONG(20),HTIME(2),IBAR(5,100),NL(2,100),          UPDATE
     *               NPTSPB(20),NPTPLY(20),NTHRNS(20),NBLTPH(5)         UPDATE
      DIMENSION TQTEST(3),LOCK(8,3) ,T(3)                               UPDATE
      DATA LOCK/-8, 6, 5, 7,-3,-2,-4, 1,                                UPDATE
     *          6,-8, 4,-3, 7,-1,-5, 2,                                 UPDATE
     *          5, 4,-8,-2,-1, 7,-6, 3/                                 UPDATE
C                                                                       UPDATE
C     CALL AIRBG3 FOR AIRBAG, IF ANY.                                   UPDATE
C                                                                       UPDATE
      IF  (NBAG.NE.0)  CALL AIRBG3(I)                                   UPDATE
      IF  (I.EQ.2)  GO TO 42                                            UPDATE
      CALL ELTIME (1,7)                                                 UPDATE
      IF  (NPL.LE.0)  GO TO 13                                          UPDATE
C                                                                       UPDATE
C     CALL UPDFDC FOR EACH ALLOWED PLANE-SEGMENT CONTACT.               UPDATE
```

```
C                                                                    UPDATE
      NPSF = 0                                                       UPDATE
      DO 12 J=1,NPL                                                  UPDATE
      NK = MNPL(J)                                                   UPDATE
      IF (NK.LE.0) GO TO 12                                          UPDATE
      DO 11 K = 1, NK                                                UPDATE
      NPSF = NPSF+1                                                  UPDATE
      NT = NTPL(K,J)                                                 UPDATE
      NF = NTAB(NT+5)                                                UPDATE
      CALL UPDFDC(NT)                                                UPDATE
      IF (NT.GT.0.OR.TAB(NF+3).EQ.0.0) GO TO 11                      UPDATE
      CALL IMPULS(1,K,J)                                             UPDATE
      I = -1                                                         UPDATE
   11 CONTINUE                                                       UPDATE
   12 CONTINUE                                                       UPDATE
   13 IF (NBLT.LE.0) GO TO 16                                        UPDATE
C                                                                    UPDATE
C     CALL UPDFDC FOR EACH ALLOWED BELT-SEGMENT CONTACT.             UPDATE
C                                                                    UPDATE
      DO 15 J=1,NBLT                                                 UPDATE
      NK = MNBLT(J)                                                  UPDATE
      IF (NK.LE.0) GO TO 15                                          UPDATE
      DO 14 K = 1,NK                                                 UPDATE
      NT = NTBLT(K,J)                                                UPDATE
      NF = NTAB(NT+5)                                                UPDATE
      NT6 = NT+6                                                     UPDATE
      CALL UPDFDC(NT)                                                UPDATE
C                                                                    UPDATE
C         AND FOR 2ND FUNCTION, IF FULL BELT FRICTION.               UPDATE
C                                                                    UPDATE
   14 IF (NF.NE.0) CALL UPDFDC(NT6)                                  UPDATE
   15 CONTINUE                                                       UPDATE
C                                                                    UPDATE
C     CALL UPDFDC FOR EACH ALLOWED SEGMENT-SEGMENT CONTACT.          UPDATE
C                                                                    UPDATE
   16 NSSF = 0                                                       UPDATE
      DO 18 J=1,NSEG                                                 UPDATE
      NK = MNSEG(J)                                                  UPDATE
      IF (NK.LE.0) GO TO 18                                          UPDATE
      DO 17 K = 1,NK                                                 UPDATE
      NSSF = NSSF+1                                                  UPDATE
      NT = NTSEG(K,J)                                                UPDATE
      NF = NTAB(NT+5)                                                UPDATE
      CALL UPDFDC(NT)                                                UPDATE
      IF (NT.GT.0.OR.TAB(NF+3).EQ.0.0) GO TO 17                      UPDATE
      CALL IMPULS(3,K,J)                                             UPDATE
      I = -1                                                         UPDATE
   17 CONTINUE                                                       UPDATE
   18 CONTINUE                                                       UPDATE
      IF (NHRNSS.LE.0) GO TO 71                                      UPDATE
C                                                                    UPDATE
C     CALL UPDFDC FOR EACH BELT OF HARNESS-BELT SYSTEMS.             UPDATE
```

```
C
      CALL HPTURB
      J1 = 1
      K1 = 1
      DO 70 II=1,NHRNSS
      IF (NBLTPH(II).LE.0) GO TO 70
      J2 = J1 + NBLTPH(II) - 1
      DO 69 J=J1,J2
      IF  (NPTPLY(J).LE.0)  GO TO 69
      NT = NTHRNS(J)
      CALL UPDFDC(NT)
      K2 = K1 + NPTPLY(J) - 1
      DO  68  K=K1,K2
      KI = NL(1,K)
      NT = IBAR(3,KI)
      CALL UPDFDC(NT)
   68 CONTINUE
      K1 = K2+1
   69 CONTINUE
      J1 = J2+1
   70 CONTINUE
   71 IF (NJNT.LE.0) GO TO 37
C
C            CHECK FOR IMPULSE ON JOINT STOPS
C     TO BE CALLED IF IN JOINT STOP (JSTOP(1)=1) THIS TIME STEP
C     BUT NOT IN IN JOINT STOP (JSTOP(2)=0) AT PREVIOUS TIME.
C
      DO 21 K=1,NJNT
      IF (JNT(K).EQ.0) GO TO 21
      IF (IABS(IPIN(K)).NE.4 .AND. VISC(7,3*K-2).EQ.0.0) GO TO 20
      DO 19 J=1,3
      K3J = 3*K-3+J
      IF (IABS(IPIN(K)).NE.4) K3J=3*K-2
      IF (IABS(IPIN(K)).EQ.4 .AND. VISC(7,K3J).EQ.0.0) GO TO 19
      IF (JSTOP(J,1,K).NE.1.OR.JSTOP(J,2,K).NE.0) GO TO 19
      CALL IMPULS(4,J,K)
      I = -1
   19 JSTOP(J,2,K) = JSTOP(J,1,K)
   20 IF (IGLOB(K).EQ.0) GO TO 21
      NT = IGLOB(K)
      MT = NTAB(NT+5)
      NT1 = NTAB(NT+2)
      NTAB(NT+2) = 0
      CALL UPDFDC(NT)
      NT = IABS(NT)
      NTAB(NT+2) = NT1
      IF (TAB(MT+3).EQ.0.0) GO TO 21
      IF (JSTOP(4,1,K).NE.1.OR.JSTOP(4,2,K).NE.0) GO TO 21
      CALL IMPULS(4,4,K)
      I = -1
   21 JSTOP(4,2,K) = JSTOP(4,1,K)
C
```

```
C     TEST TO LOCK OR UNLOCK JOINTS                                     UPDATE
C                                                                       UPDATE
C                                                                       UPDATE
C     CONDITIONS TO CHANGE SIGN OF IPIN(J)                              UPDATE
C                                                                       UPDATE
C                 PINNED               UNPINNED                         UPDATE
C         LOCKED (-1) !H.TQ! > T1    (-2) !TQ! > T1                     UPDATE
C                                                                       UPDATE
C      UNLOCKED  (+1) !H.TQ! < T2    (+2) !TQ! < T2                     UPDATE
C                            OR                 OR                      UPDATE
C                         WJ  < T3           WJ  < T3                   UPDATE
C                                                                       UPDATE
      DO 28 J=1,NJNT                                                    UPDATE
      IF (IABS(IPIN(J)).EQ.4) GO TO 28                                  UPDATE
      IF (IPIN(J)) 22,28,23                                             UPDATE
   22 T1 = VISC(4,3*J-2)                                                UPDATE
      IF (T1.EQ.0.0) GO TO 28                                           UPDATE
      IF (IPIN(J).GT.-1) GOTO 51                                        SLIP
      IF (IPIN(J).GT.-6.AND.IPIN(J).LT.-1) GOTO 51                      SLIP
      TQM = XDY(HB(1,2*J),D(1,1,J+1),TQ(1,J))                           UPDATE
      ABSTQM = DABS(TQM)                                                UPDATE
      IF  (ABSTQM.GT.T1)  HA(2,2*J-1) = TQM                             UPDATE
      TQM = ABSTQM                                                      UPDATE
      GO TO 52                                                          UPDATE
   51 TQM = DSQRT(TQ(1,J)**2 + TQ(2,J)**2 + TQ(3,J)**2)                 UPDATE
      IF  (TQM.GT.T1)  CALL DOT31(HIR(1,1,J),TQ(1,J),HA(1,2*J-1))       UPDATE
   52 IF  (TQM-T1)  28,28,26                                            UPDATE
   23 T2 = VISC(5,3*J-2)                                                UPDATE
      IF  (HA(2,2*J).NE.0.0)  GO TO 54                                  UPDATE
      DO  53  K=1,3                                                     UPDATE
   53 HA(K,2*J-1) = 0.0                                                 UPDATE
   54 IF  (T2.EQ.0.0)  GO TO 24                                         UPDATE
      IF (IPIN(J).GE.2.AND.IPIN(J).LE.5)                                SLIP
     *     TQM = DSQRT(TQ(1,J)**2+TQ(2,J)**2+TQ(3,J)**2)                SLIP
      IF (IPIN(J).EQ.1.OR.IPIN(J).EQ.6.OR.IPIN(J).EQ.7)                 SLIP
     *     TQM = DABS(XDY(HB(1,2*J),D(1,1,J+1),TQ(1,J)))                SLIP
      IF (TQM-T2) 25,28,28                                              UPDATE
   24 T3 = VISC(6,3*J-2)                                                UPDATE
      IF (T3.EQ.0.0) GO TO 28                                           UPDATE
      IF (WJ(J)-T3) 25,28,28                                            UPDATE
   25 CALL IMPLS2(0,J,HB(1,2*J))                                        UPDATE
      I = -1                                                            UPDATE
   26 IPIN(J) = -IPIN(J)                                                UPDATE
      TMSEC = 1000.0*TIME                                               UPDATE
      IPINJ = -IPIN(J)                                                  UPDATE
      WRITE (6,27) TMSEC,J,IPINJ,IPIN(J)                                UPDATE
   27 FORMAT('0 AT TIME =',F9.3,' MSEC,    IPIN(',I2,                   BUTLER1
     *       ') HAS BEEN CHANGED FROM',I3,' TO',I3)                     BUTLER1
   28 CONTINUE                                                          UPDATE
C                                                                       UPDATE
C     TEST TO LOCK OR UNLOCK EULER JOINTS AXES.                         UPDATE
C     USE SAME TEST AS ABOVE BUT ON EACH AXIS SERARATELY.               UPDATE
```

```
C                                                                       UPDATE
C       IF LOCK(IEULER,K) IS NEGATIVE, AXIS K IS LOCKED;                UPDATE
C          TO UNLOCK AXIS SET IEULER TO -LOCK(IEULER,K).                UPDATE
C                                                                       UPDATE
C       IF LOCK(IEULER,K) IS POSITIVE, AXIS K IS UNLOCKED;              UPDATE
C         TO LOCK AXIS SET IEULER TO LOCK(IEULER,K).                    UPDATE
C                                                                       UPDATE
      DO 36 J=1,NJNT                                                    UPDATE
      IF (IABS(IPIN(J)).NE.4) GO TO 36                                  UPDATE
      JEULER = IEULER(J)                                                UPDATE
      CALL DOT31(HIR(1,1,J),TQ(1,J),TQTEST)                             UPDATE
      DO 31 K=1,3                                                       UPDATE
      K3J = 3*J-3+K                                                     UPDATE
      NLOCK = LOCK(JEULER,K)                                            UPDATE
      IF (NLOCK.GT.0) GO TO 29                                          UPDATE
      IF (VISC(4,K3J).EQ.0.0) GO TO 31                                  UPDATE
      IF (DABS(TQTEST(K)).LE.VISC(4,K3J)) GO TO 31                      UPDATE
      JEULER = -NLOCK                                                   UPDATE
      HA(K,2*J-1) = TQTEST(K)                                           UPDATE
      GO TO 31                                                          UPDATE
   29 IF  (HA(K,2*J).EQ.0.0)  HA(K,2*J-1) = 0.0                         UPDATE
      IF (VISC(5,K3J).EQ.0.0) GO TO 30                                  UPDATE
      IF (DABS(TQTEST(K)).LT.VISC(5,K3J)) JEULER =  NLOCK               UPDATE
      GO TO 31                                                          UPDATE
   30 IF (VISC(6,K3J).EQ.0.0) GO TO 31                                  UPDATE
      IF (DABS(ANGD(K,J)).LT.VISC(6,K3J)) JEULER =  NLOCK               UPDATE
   31 CONTINUE                                                          UPDATE
      IF (JEULER.EQ.IEULER(J)) GO TO 36                                 UPDATE
      TMSEC = 1000.0*TIME                                               UPDATE
      WRITE (6,32) TMSEC,J,IEULER(J),JEULER                             UPDATE
   32 FORMAT('0 AT TIME =',F9.3,' MSEC, IEULER(',I2,                    BUTLER1
     *       ') HAS BEEN CHANGED FROM',I3,' TO',I3)                     BUTLER1
      IF (JEULER.EQ.8)            GO TO 35                              UPDATE
      IF (IEULER(J).EQ.7) GO TO 35                                      UPDATE
      IF (IEULER(J).EQ.6 .AND. (JEULER.EQ.2.OR.JEULER.EQ.1)) GO TO 35   UPDATE
      IF (IEULER(J).EQ.5 .AND. (JEULER.EQ.3.OR.JEULER.EQ.1)) GO TO 35   UPDATE
      IF (IEULER(J).EQ.4 .AND. (JEULER.EQ.3.OR.JEULER.EQ.2)) GO TO 35   UPDATE
      MODE = -1                                                         UPDATE
      K = JEULER                                                        UPDATE
      IF (K.GT.3) GO TO 33                                              UPDATE
      IF (K.EQ.2) GO TO 34                                              UPDATE
      K4 = 4-K                                                          UPDATE
      CALL CROSS (HIR(1,K4,J),HIR(1,2,J),T)                             UPDATE
      IEULER(J) = 8                                                     UPDATE
      IPIN(J)   = 4                                                     UPDATE
      CALL IMPLS2(MODE,J,T)                                             UPDATE
      I = -1                                                            UPDATE
      GO TO 35                                                          UPDATE
   33 MODE =  1                                                         UPDATE
      K = K-3                                                           UPDATE
      IF (K.GT.3) MODE=0                                                UPDATE
   34 IEULER(J) = 8                                                     UPDATE
```

```
      IPIN(J)    = 4                                                    UPDATE
      CALL IMPLS2(MODE,J,HIR(1,K,J))                                    UPDATE
      I = -1                                                            UPDATE
   35 IEULER(J) = JEULER                                                UPDATE
      IPIN(J) = 4                                                       UPDATE
      IF (IEULER(J).NE.8) IPIN(J) = -4                                  UPDATE
C     GET SINE AND COSINE OF NUTATION IF IEULER GOES TO STATE 2         JDRIFT
      CALL EJOINT(-1,J)                                                 JDRIFT
      IF(JEULER.NE.2) GOTO 36                                           JDRIFT
      TQM=ANG(2,J)+CONST(2,J)                                           JDRIFT
      CONST(4,J) = DCOS(TQM)                                            JDRIFT
      CONST(5,J) = DSIN(TQM)                                            JDRIFT
   36 CONTINUE                                                          UPDATE
      DO 90 J = 1,NJNT                                                  SLIP
      IF (IABS(IPIN(J)).LE.4) GO TO 90                                  SLIP
      IF (IEULER(J).GE.0) GO TO 90                                      SLIP
      IF (CONST(1,J).EQ.0.0.AND.CONST(2,J).EQ.0.0) GO TO 90             SLIP
      M = JNT(J)                                                        SLIP
      FTEST = XDY(HT(1,3,2*J-1),D(1,1,M),F(1,J))                        SLIP
      IF (FTEST.GE.CONST(1,J).AND.FTEST.LE.CONST(2,J)) GO TO 90         SLIP
      IEULER(J) = 0                                                     SLIP
      TMSEC = 1000.0*TIME                                               SLIP
      WRITE (6,88) TMSEC,J                                              SLIP
   88 FORMAT(/'0 AT TIME =',F9.3,' MSEC,  JOINT ',I3,' HAS BEEN',       SLIP
     *  ' UNLOCKED AND ALLOWED TO SLIP.'/)                              SLIP
   90 CONTINUE                                                          SLIP
C     F IS THE FORCE ON SEGMENT J+1, - F IS ON SEGMENT M                SLIP
C                                                                       UPDATE
   37 IF  (NQ.LE.0)  GO TO 41                                           UPDATE
      DO 40 K=1,NQ                                                      UPDATE
      IF (KQTYPE(K).LT.3) GO TO 40                                      UPDATE
      IF (KQTYPE(K).GT.4) GO TO 40                                      UPDATE
      IF (CFQQ(K).LT.0.0) KQTYPE(K) = -KQTYPE(K)                        UPDATE
      IF (CFQQ(K).LT.0.0) GO TO 39                                      UPDATE
C                                                                       UPDATE
C     TEST IF ROLLING CONSTRAINT SHOULD BE SLIDING AND VICE VERSA.      UPDATE
C                                                                       UPDATE
      QN = -XDY(TQQ(1,K),HHT(1,1,K),QQ(1,K))                            UPDATE
      IF (NPRT(24).NE.0) WRITE (6,38) KQTYPE(K),KQ1(K),KQ2(K),          UPDATE
     *                     (RK1(II,K),II=1,3),(RK2(II,K),II=1,3),       UPDATE
     *                     ((HHT(II,J,K),J=1,3),II=1,3),                UPDATE
     *      (QQ(II,K),II=1,3),(TQQ(II,K),II=1,3),(RQQ(II,K),II=1,3),    UPDATE
     *                (HQQ(II,K),II=1,3),SQQ(K),CFQQ(K),QN              UPDATE
   38 FORMAT('0 UPDATE ROLL-SLIDE TEST'/(2X,9G14.6))                    UPDATE
      IF (QN.LT.0.0) KQTYPE(K) = -4                                     UPDATE
      IF (QN.LT.0.0) GO TO 39                                           UPDATE
      QDOTQ = QQ(1,K)**2 + QQ(2,K)**2 + QQ(3,K)**2                      UPDATE
      QT = DSQRT(QDOTQ-QN**2)                                           UPDATE
      IF (KQTYPE(K).EQ.3 .AND. QT.LE.CFQQ(K)*QN) GO TO 40               UPDATE
      IF (KQTYPE(K).EQ.4 .AND. QT.GE.0.9*CFQQ(K)*QN) GO TO 40           UPDATE
      KQTYPE(K) = 7-KQTYPE(K)                                           UPDATE
   39 CALL OUTPUT(0)                                                    UPDATE
```

```
      CALL SETUP2                                                      UPDATE
      CALL DAUX(K)                                                     UPDATE
      IF  (NPRT(24).NE.0)  CALL OUTPUT(1)                              UPDATE
      IF  (NPRT( 3).NE.0)  CALL PRINT (6HUPDATE)                       UPDATE
      I = -1                                                           UPDATE
   40 CONTINUE                                                         UPDATE
   41 CALL ELTIME(2,7)                                                 UPDATE
   42 RETURN                                                           UPDATE
      END                                                              UPDATE
```

```
      SUBROUTINE  UPDFDC  (M)                                           UPDFDC
C                                              REV III.2 08/08/84REVIII
C     UPDATE FORCE DEFLECTION CURVE DEFINITION THAT IS DEFINED          UPDFDC
C     IN LOCATION M OF NTAB ARRAY.  SUBROUTINE ASSUMES THAT             UPDFDC
C     A SUCCESSFUL INTEGRATION STEP HAS JUST BEEN COMPLETED AND         UPDFDC
C     WILL COMPUTE ENTIRE CURVE DEFINITION TO BE VALID FOR NEXT STEP.   UPDFDC
C                                                                       UPDFDC
      IMPLICIT REAL*8(A-H,O-Z)                                          UPDFDC
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
       L      = NTAB(M)                                                 UPDFDC
      IF (L.EQ.0)  GO TO 99                                             UPDFDC
      D       = TAB(L)                                                  UPDFDC
      IF (D.LT.0.0) D = 0.0                                             UPDFDC
      DLAST  = TAB(L+1)                                                 UPDFDC
      IF (D.EQ.DLAST)  GO TO 99                                         UPDFDC
      DCUBIC = TAB(L+6)                                                 UPDFDC
      IF (D.EQ.DCUBIC) GO TO 98                                         UPDFDC
      AREA    = TAB(L+2)                                                UPDFDC
      RLAST   = TAB(L+3)                                                UPDFDC
      GLAST   = TAB(L+4)                                                UPDFDC
      DG      = TAB(L+5)                                                UPDFDC
      DGO     = DG                                                      UPDFDC
      DREF    = TAB(L+7)                                                UPDFDC
      DMAX    = TAB(L+8)                                                UPDFDC
      DINER   = TAB(L+9)                                                UPDFDC
      FDMAX   = TAB(L+10)                                               UPDFDC
      DCO     = TAB(L+18)                                               UPDFDC
      LQ      = L+11                                                    UPDFDC
      LC      = L+14                                                    UPDFDC
      IF (NTAB(M+1).LT.0) GO TO 98                                      UPDFDC
      IF (D-DCUBIC) 10,98,20                                            UPDFDC
C                                                                       UPDFDC
C     D < DCUBIC, DEFINE NEW CUBIC                                      UPDFDC
C     Y(X) = A0 + A1*(X-X1) + A2*(X-X1)**2 + A3*(X-X1)**3               UPDFDC
C     WHOSE DERIVATIVE IS                                               UPDFDC
C     Y'(X) = A1 + 2*A2*(X-X1) + 3*A3+(X-X1)**2                         UPDFDC
C                                                                       UPDFDC
   10 X1 = DMAX1 (D,DG)                                                 UPDFDC
      X2 = DREF                                                         UPDFDC
C                                                                       UPDFDC
C     IF INERTIAL SPIKE EXISTS AND IF DIMAX < DREF , DROP INERTIAL SPIKEUPDFDC
      NI = NTAB(M+2)                                                    UPDFDC
      IF (NI.GT.0.AND.TAB(NI+3).GT.0.0.AND.DREF.GT.TAB(NI+3))NTAB(M+2)=0UPDFDC
      DX = X2-X1                                                        UPDFDC
      X = X1-DG                                                         UPDFDC
      Y1 = TAB(LQ) +X *(TAB(LQ+1)+X *TAB(LQ+2))                         UPDFDC
      Y1P = TAB(LQ+1)+2.0*X *TAB(LQ+2)                                  UPDFDC
      X2DOT = 0.0                                                       UPDFDC
      CALL FRCDFL (X2,X2DOT,M,0,Y2P,ELOSS)                              UPDFDC
      CALL FRCDFL (X2,X2DOT,M,1,Y2 ,ELOSS)                              UPDFDC
      DCUBIC = X1                                                       UPDFDC
      DCO     = DCUBIC                                                  UPDFDC
```

```
C                                                                       UPDFDC
C     A0 = Y(X1)    (THE VALUE OF THE QUADRATIC AT X1)                  UPDFDC
C     A1 = Y'(X1)   (THE DERIVATIVE OF THE QUADRATIC AT X1)             UPDFDC
C                                                                       UPDFDC
      A0 = Y1                                                           UPDFDC
      A1 = Y1P                                                          UPDFDC
C                                                                       UPDFDC
C     SOLVE SIMULTANEOUSLY FOR A2 AND A3                                UPDFDC
C        A2*(X2-X1)**2 +    A3*(X2-X1)**3 = Y(X2)-A0-A1*(X2-X1)         UPDFDC
C      2*A2*(X2-X1)    +  3*A3*(X2-X1)**2 = Y'(X2)-A1                   UPDFDC
C                                                                       UPDFDC
      R13 = (Y2 - Y1 -Y1P*DX)/DX**2                                     UPDFDC
      R23 = (Y2P - Y1P)/DX                                              UPDFDC
      A2  = 3.0*R13 - R23                                               UPDFDC
      A3  = (R23 - 2.0*R13)/DX                                          UPDFDC
C                                                                       UPDFDC
C     IF LOCAL MINIMUN OF CUBIC (ABSCISSA VALUE WHERE Y'(X) = 0)        UPDFDC
C     LIES BETWEEN DCUBIC AND DREF AND IS NEGATIVE, THEN REPLACE        UPDFDC
C     CUBIC DEFINITION WITH STRAIGHT LINE BETWEEN (X1,Y1) AND (X2,Y2).  UPDFDC
C                                                                       UPDFDC
      IF (A3.NE.0.0)  GO TO 14                                          UPDFDC
      R2 = -0.5*A1/A2                                                   UPDFDC
      GO TO 15                                                          UPDFDC
   14 A33 = 3.0*A3                                                      UPDFDC
      DISC = A2**2-A1*A33                                               UPDFDC
      IF (DISC.LT.0.0)  GO TO 13                                        UPDFDC
      SQDISC = DSQRT(DISC)                                              UPDFDC
      R1 = (-A2+SQDISC)/A33                                             UPDFDC
      IF (R1.LE.0.0.OR.R1.GE.DX)  GO TO 11                              UPDFDC
      FR1 = A0+R1*(A1+R1*(A2+R1*A3))                                    UPDFDC
      IF (FR1.LT.0.0) GO TO 12                                          UPDFDC
   11 R2 = (-A2-SQDISC)/A33                                             UPDFDC
   15 IF (R2.LE.0.0.OR.R2.GE.DX) GO TO 13                               UPDFDC
      FR2 = A0+R2*(A1+R2*(A2+R2*A3))                                    UPDFDC
      IF (FR2.GE.0.0)  GO TO 13                                         UPDFDC
   12 A0 = Y1                                                           UPDFDC
      A1 = (Y2-Y1)/DX                                                   UPDFDC
      A2 = 0.0                                                          UPDFDC
      A3 = 0.0                                                          UPDFDC
   13 TAB(LC) = A0                                                      UPDFDC
      TAB(LC+1) = A1                                                    UPDFDC
      TAB(LC+2) = A2                                                    UPDFDC
      TAB(LC+3) = A3                                                    UPDFDC
      TAB(L +6) = DCUBIC                                                UPDFDC
      TAB(L+18) = DCO                                                   UPDFDC
      GO TO 98                                                          UPDFDC
   20 IF (D-DREF) 21,21,30                                              UPDFDC
C                                                                       UPDFDC
C     DCUBIC < D < DREF, DEFINE NEW QUADRATIC FROM CUBIC CURVE.         UPDFDC
C                                                                       UPDFDC
   21 X = D-DCO                                                         UPDFDC
      Y2 = TAB(LC)+X*(TAB(LC+1)+X*(TAB(LC+2)+X*TAB(LC+3)))              UPDFDC
```

```
      X1 = DCUBIC - DG                                                  UPDFDC
      AREA = X1*(TAB(LQ)+X1*(TAB(LQ+1)/2.0+X1*TAB(LQ+2)/3.0))           UPDFDC
     * + X*(TAB(LC)+X*(TAB(LC+1)/2.0+X*(TAB(LC+2)/3.0+X*TAB(LC+3)/4.0)))UPDFDC
      X = DCUBIC - DCO                                                  UPDFDC
      IF (X.NE.0.0) AREA = AREA                                         UPDFDC
     * - X*(TAB(LC)+X*(TAB(LC+1)/2.0+X*(TAB(LC+2)/3.0+X*TAB(LC+3)/4.0)))UPDFDC
      GO TO 31                                                          UPDFDC
C                                                                       UPDFDC
C     DREF < D, DEFINE NEW QUADRATIC FROM BASE CURVE.                   UPDFDC
C                                                                       UPDFDC
C     IF DINER < D , REMOVE INERTIAL SPIKE                              UPDFDC
C                                                                       UPDFDC
   30 IF  (NTAB(M+2).GT.0 .AND. D.GE.DINER)  NTAB(M+2) = 0              UPDFDC
      NR = NTAB(M+3)                                                    UPDFDC
      RLAST = 1.0                                                       UPDFDC
      IF (NR.GT.0  ) RLAST = EVALFD(D,NR,1)                             UPDFDC
      IF (RLAST.NE.1.0) GO TO 39                                        UPDFDC
C                                                                       UPDFDC
C     R = 1,  USE BASE CURVE FOR UNLOADING                              UPDFDC
C                                                                       UPDFDC
      DG = 0.0                                                          UPDFDC
      DCUBIC = 0.0                                                      UPDFDC
      DREF = 0.0                                                        UPDFDC
      A0 = 0.0                                                          UPDFDC
      A1 = 0.0                                                          UPDFDC
      A2 = 0.0                                                          UPDFDC
      GO TO 32                                                          UPDFDC
   39 NG = NTAB(M+4)                                                    UPDFDC
      GLAST = 0.0                                                       UPDFDC
      IF (NG.GT.0  ) GLAST = EVALFD(D,NG,1)                             UPDFDC
      NB =  NTAB(M+1)                                                   UPDFDC
      D0 = TAB(NB)                                                      UPDFDC
      DG = D0 + GLAST*(D-D0)                                            UPDFDC
      Y2 = EVALFD(D, NB,1)                                              UPDFDC
      NI = NTAB(M+2)                                                    UPDFDC
      IF (NI.GT.0) Y2 = Y2+EVALFD(D,NI,1)                               UPDFDC
      AREA = EVALFD(D,NB,2)                                             UPDFDC
      DREF = D                                                          UPDFDC
   31 DCUBIC = D                                                        UPDFDC
      X1 = DG                                                           UPDFDC
      X2 = D                                                            UPDFDC
      DX = X2-X1                                                        UPDFDC
      Y1 = 0.0                                                          UPDFDC
      RAREA = RLAST*AREA                                                UPDFDC
C                                                                       UPDFDC
C     COMPUTE UNLOADING QUADRATIC COEFFICIENTS SUCH THAT                UPDFDC
C     ENDPOINT DERIVATES ARE NON-NEGATIVE.                              UPDFDC
C                                                                       UPDFDC
      A0  = 0.0                                                         UPDFDC
      A1  = 2.0/DX*(3.0*RAREA/DX-Y2)                                    UPDFDC
      IF (A1.LT.0.0)  A1 = 0.0                                          UPDFDC
      A2 = (Y2/DX-A1)/DX                                                UPDFDC
```

```
      IF (A2.GE.0.0) GO TO 32                                          UPDFDC
      A1 = Y2/DX                                                       UPDFDC
      A2 = 0.0                                                         UPDFDC
C                                                                      UPDFDC
C     RESTORE TAB VALUES THAT MAY HAVE BEEN CHANGED                    UPDFDC
C                                                                      UPDFDC
   32 TAB(L+2) = AREA                                                  UPDFDC
      TAB(L+3) = RLAST                                                 UPDFDC
      TAB(L+4) = GLAST                                                 UPDFDC
      TAB(L+5) = DG                                                    UPDFDC
      TAB(L+6) = DCUBIC                                                UPDFDC
      TAB(L+7) = DREF                                                  UPDFDC
      TAB(LQ)   = A0                                                   UPDFDC
      TAB(LQ+1) = A1                                                   UPDFDC
      TAB(LQ+2) = A2                                                   UPDFDC
   98 TAB(L+1) = D                                                     UPDFDC
      IF (D.GT.DG0 .AND. DLAST.LE.DG0) M=-M                            UPDFDC
   99 RETURN                                                           UPDFDC
      END                                                              UPDFDC
```

```
      SUBROUTINE VEHPOS                                                 VEHPOS
C                                                  REV IV    07/23/86TWOPI
C     COMPUTES COMPONENTS OF VEHICLE ACCELERATIONS ONLY AS A FUNCTION   VEHPOS
C     OF TIME USING DATA AND TABLES PRODUCED BY SUBROUTINE VINPUT.      VEHPOS
C                                                                       VEHPOS
      IMPLICIT REAL*8 (A-H,O-Z)                                         VEHPOS
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           VEHPOS
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),VEHPOS
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       VEHPOS
      COMMON/VPOSTN/ ZPLT(3),SPLT(3),AXV(3,6),VATAB(6,501,6),           VEHICL
     *               VT0(6),VDT(6),TIMEV(6),OMEGV(6),NVTAB(6),INDXV(6)  VEHPOS
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         VEHPOS
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      DIMENSION AX(3)                                                   VEHPOS
      T = TIME                                                          VEHPOS
      M = 1                                                             VEHPOS
   15 DO  16  I=1,3                                                     VEHPOS
   16 AX(I) = AXV(I,M)                                                  VEHPOS
      AT0 = VT0(M)                                                      VEHPOS
      ADT = VDT(M)                                                      VEHPOS
      VTIME = TIMEV(M)                                                  VEHPOS
      OMEG  = OMEGV(M)                                                  VEHPOS
      NATAB = NVTAB(M)                                                  VEHPOS
      K = INDXV(M)                                                      VEHPOS
      IF(NATAB.NE.0) GO TO 20                                           VEHPOS
C                                                                       VEHPOS
C     HALF-SINE WAVE DECELERATION                                       VEHPOS
C                                                                       VEHPOS
      IF(T.GT.VTIME) T=VTIME                                            VEHPOS
      WT = OMEG*T                                                       VEHPOS
      SWT = DSIN(WT)                                                    VEHPOS
      DO 10 I=1,3                                                       VEHPOS
      AW = AX(I)*OMEG                                                   VEHPOS
      SEGLA(I,K) = -AW*OMEG*SWT                                         VEHPOS
   10 WMEGD(I,K) = 0.0                                                  VEHPOS
      GO TO 99                                                          VEHPOS
   20 IF (NATAB.LT.0) GO TO 30                                          VEHPOS
C                                                                       VEHPOS
C      UNIDIRECTIONAL DECELERATION                                      VEHPOS
C                                                                       VEHPOS
      IF (T.LT.VTIME) GO TO 21                                          VEHPOS
C                                                                       VEHPOS
C     TIME POINT EXCEEDS TABLE, USE LAST VALUES OF ACCELERATION.        VEHPOS
C                                                                       VEHPOS
      AC0 = VATAB(1,NATAB,M)                                            VEHPOS
      GO TO 25                                                          VEHPOS
C                                                                       VEHPOS
C         USE QUADRATIC INTERPOLATION FROM TABLES FOR CURRENT VALUE OF  VEHPOS
C         TIME TO BE CONSISTENT WITH SIMPSON INTEGRATION OF TABLES.     VEHPOS
C                                                                       VEHPOS
   21 J= 0.5*(T-AT0)/ADT +1.0                                           VEHPOS
```

```
      XK = T/ADT -DFLOAT(2*J-1)                                         VEHPOS
      X1 = XK+1.0                                                       VEHPOS
      X3 = XK-1.0                                                       VEHPOS
      AC0 = 0.5*XK*X3*VATAB(1,2*J-1,M)                                  VEHPOS
     *    -     X3*X1*VATAB(1,2*J  ,M)                                  VEHPOS
     *    + 0.5*XK*X1*VATAB(1,2*J+1,M)                                  VEHPOS
C                                                                       VEHPOS
C        COMPONENTS OF VEHICLE ACCELERATION.                            VEHPOS
C                                                                       VEHPOS
   25 DO 29 I=1,3                                                       VEHPOS
      SEGLA(I,K) = -G*AX(I)*AC0                                         VEHPOS
   29 WMEGD(I,K) = 0.0                                                  VEHPOS
      GO TO 99                                                          VEHPOS
C                                                                       VEHPOS
C       OMNIDIRECTIONAL DECELERATION                                    VEHPOS
C                                                                       VEHPOS
   30 J = (TIME-AT0)/ADT + 1.0                                          VEHPOS
      IF (J.GE.-NATAB) GO TO 32                                         VEHPOS
C                                                                       VEHPOS
C         INTERPOLATION FROM VINPUT TABLES OF COMPONENTS OF VEHICLE     VEHPOS
C         LINEAR AND ANGULAR ACCELERATION.                              VEHPOS
C                                                                       VEHPOS
      TJ        = AT0 + DFLOAT(J-1)*ADT                                 VEHPOS
      DLT       = TIME-TJ                                               VEHPOS
      R1 = DLT/ADT                                                      VEHPOS
      R2 = 1.0-R1                                                       VEHPOS
      DO 31 I=1,3                                                       VEHPOS
      SEGLA(I,K) =      -G*(VATAB(I  ,J+1,M)*R1 + VATAB(I  ,J,M)*R2)    VEHPOS
   31 WMEGD(I,K) = RADIAN*(VATAB(I+3,J+1,M)*R1 + VATAB(I+3,J,M)*R2)    VEHPOS
      GO TO 99                                                          VEHPOS
C                                                                       VEHPOS
C     TIME POINT EXCEEDS TABLE, USE LAST VALUES OF ACCELERATION.        VEHPOS
C                                                                       VEHPOS
   32 J = - NATAB                                                       VEHPOS
      DO 33 I=1,3                                                       VEHPOS
      SEGLA(I,K) =      -G*VATAB(I  ,J,M)                               VEHPOS
   33 WMEGD(I,K) = RADIAN*VATAB(I+3,J,M)                                VEHPOS
   99 M = M+1                                                           VEHPOS
      IF  (M.LE.6 .AND. INDXV(M).NE.0)  GO TO 15                        VEHPOS
      RETURN                                                            VEHPOS
      END                                                               VEHPOS
```

```
      SUBROUTINE VINPUT                                                 VINPUT
C                                                    REV IV    07/24/86SLIP
C     PERFORMS CARD INPUT AND COMPUTES DATA AND TABLES REQUIRED BY      VINPUT
C     SUBROUTINE VEHPOS TO INTEGRATE THE CRASH VEHICLE MOTION FOR ONE OFVINPUT
C     THREE PERMISSABLE OPTIONS:                                        VINPUT
C       (1) HALF SINE-WAVE LINEAR DECELERATION IMPULSE                  VINPUT
C       (2) UNIDIRECTIONAL LINEAR DECELERATION TABULAR INPUT            VINPUT
C       (3) OMNIDIRECTIONAL LINEAR AND ANGULAR ACCELERATION TABULAR     VINPUT
C           INPUT (6 DEGREES OF FREEDOM VEHICLE MOTION)                 VINPUT
C                                                                       VINPUT
      IMPLICIT REAL*8 (A-H,O-Z)                                         VINPUT
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           VINPUT
     *              NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG     PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),VINPUT
     *              SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)        VINPUT
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *              RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),      VINPUT
     *              JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)     VINPUT
      COMMON/VPOSTN/ ZPLT(3),SPLT(3),AXV(3,6),VATAB(6,501,6),           VEHICL
     *              VTO(6),VDT(6),TIMEV(6),OMEGV(6),NVTAB(6),INDXV(6)   VINPUT
      COMMON/TEMPVS/ XO(3),XDOTO(3),XCOMP(3),XVCOMP(3),ANGLE(3),        VINPUT
     *              ATAB(15,501),DVEH(3,3),VMEG(3),VMEGD(3),            VEHICL
     *             XACOMP(3),THET(3),AX(3),F(5,101),XYZ(103,6),TT(103),CHGIII
     *              VIPS,VMPH,ATO,ADT,VTIME,OMEG,NATAB                  VINPUT
     *             ,SP(5,101,4),Q1(101,4),A1(3),W1(4),QD(4),QC(4)       JTF984
     *           ,IDMMY,DMMY(23887)                                     80386
      COMMON/INTEST/ SGTEST(3,4,30),XTEST(3,120),SEGT(120),REGT(120)    VINPUT
      REAL    SEGT                                                      VINPUT
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         VINPUT
     *              UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                   TWOPI
      COMMON/TITLES/ DATE(3),COMENT(40),VPSTTL(20),BDYTTL(5),           VINPUT
     *              BLTTTL(5,8),PLTTL(5,30),BAGTTL(5,6),SEG(30),        VINPUT
     *              JOINT(30),CGS(30),JS(30)                            VINPUT
      REAL DATE,COMENT,VPSTTL,BDYTTL,BLTTTL,PLTTL,BAGTTL,SEG,JOINT      VINPUT
      LOGICAL*1 CGS,JS                                                  VINPUT
      DIMENSION IDYPR(3)                                                VINPUT
      REAL VEH(6),GRND                                                  VINPUT
      DATA VEH/4HVEH1,4HVEH2,4HVEH3,4HVEH4,4HVEH5,4HVEH /,GRND/4HGRND/  VINPUT
      DATA IDYPR/3,2,1/                                                 VINPUT
      DATA MXTAB2/99/,MXTAB3/501/,MXTAB4/101/                           MISC
C                                                                       VINPUT
C     READ AND PRINT CONTENTS OF CARDS C.1 AND C.2                      VINPUT
C                                                                       VINPUT
      NVEH = NSEG                                                       VINPUT
      NVH  = 0                                                          VINPUT
      DO   11  I=1,6                                                    VINPUT
   11 INDXV(I) = 0                                                      VINPUT
   12 READ (5,13) VPSTTL                                                VINPUT
   13 FORMAT (20A4)                                                     VINPUT
      READ(5,14) ANGLE,VIPS,VTIME,XO,NATAB,ATO,ADT,MSEG                 VINPUT
   14 FORMAT(8F6.0,I6,2F6.0,I6)                                         VINPUT
      INTAB = IABS(NATAB)                                               CHGIII
```

```
      IF (NATAB.GT.0.AND.INTAB.GT.MXTAB2) STOP 79                       MISC
      WRITE (6,15) NPG,VPSTTL,ANGLE,VIPS,VTIME,X0,NATAB,AT0,ADT,MSEG    PAGE
      NPG = NPG+1                                                        PAGE
   15 FORMAT('1 VEHICLE DECELERATION INPUTS',94X,'PAGE',I5/120X,        PAGE
     *       'CARDS C'/3X,20A4//                                         PAGE
     *    7X,'YAW',9X,'PITCH',7X,'ROLL',8X,'VIPS',8X,'VTIME',7X,'XO(X)',VINPUT
     *    7X,'XO(Y)',7X,'XO(Z)',2X,'NATAB',6X,'ATO',9X,'ADT',4X,'MSEG'/ VINPUT
     *    8F12.3,I5,2X,2F12.6,I5)                                        VINPUT
      DA1 = ANGLE(1)*RADIAN                                              VINPUT
      DA2 = ANGLE(2)*RADIAN                                              VINPUT
      AX(3) = DCOS(DA2)                                                  VINPUT
      AX(1) = DCOS(DA1)*AX(3)                                            VINPUT
      AX(2) = DSIN(DA1)*AX(3)                                            VINPUT
      AX(3) = DSIN(DA2)                                                  VINPUT
      IF(NATAB.NE.0) GO TO 18                                            VINPUT
C                                                                        VINPUT
C     HALF-SINE WAVE DECELERATION                                        VINPUT
C                                                                        VINPUT
      OMEG = PI/VTIME                                                    VINPUT
      AT = 0.5*VIPS/OMEG                                                 VINPUT
      IF (VIPS.LT.0.0) VIPS = 0.0                                        VINPUT
      DO 16 I=1,3                                                        VINPUT
      XACOMP(I) = 0.0                                                    VINPUT
      XDOTO(I) = VIPS*AX(I)                                              VINPUT
   16 AX(I) = AT*AX(I)                                                   VINPUT
      WRITE (6,17) VIPS,UNITL,UNITT,ANGLE,VTIME,UNITT                    VINPUT
   17 FORMAT('0 PASSENGER COMPARTMENT DISPLACEMENT HISTORY'/             VINPUT
     *       '  ANALYTICAL HALF-SINE WAVE DECELERATION'/                 VINPUT
     *       '  VO=',F8.3,1X,A4,'/',A4,', OBLIQUE ANGLES =',3F7.2,       VINPUT
     *       ' DEGREES, TIME DURATION =',F7.3,1X,A4//)                   VINPUT
      GO TO 28                                                           VINPUT
   18 IF (NATAB.LT.0) GO TO 31                                           VINPUT
C                                                                        VINPUT
C     FOR UNIDIRECTIONAL VEHICLE MOTION                                  VINPUT
C     READ LINEAR DECELERATION TABLES FROM CARDS C.3                     VINPUT
C                                                                        VINPUT
      READ (5,19) (ATAB(1,I),I=1,NATAB)                                  VINPUT
   19 FORMAT (12F6.0)                                                    VINPUT
C                                                                        VINPUT
C     EXTEND TABLE IF NECESSARY SUCH THAT NATAB IS ODD AND               VINPUT
C     LAST ENTRY NEED NOT BE ZERO. IF TABLE SIZE IS EXCEEDED ON TIME,    VINPUT
C     VALUE OF LAST ENTRY WILL BE USED.                                  VINPUT
C                                                                        VINPUT
      IF (MOD(NATAB,2).EQ.1) GO TO 20                                    VINPUT
      ATAB(1,NATAB+1) = ATAB(1,NATAB)                                    VINPUT
      NATAB = NATAB+1                                                    VINPUT
   20 VTIME = ADT * DFLOAT(NATAB-1)                                      VINPUT
C                                                                        VINPUT
C     USING SIMPSON'S INTEGRATION, COMPUTE VELOCITY AND DISPLACEMENT     VINPUT
C     TABLE FOR NATAB EQUALLY SPACED (ADT) TIME POINTS.                  VINPUT
C     FOR I=1,NATAB                                                      VINPUT
C       ATAB(1,I) = LINEAR DECELERATION (G'S)                            VINPUT
```

```
C       ATAB(2,I) = LINEAR VELOCITY (L UNITS/T UNITS)                    VINPUT
C       ATAB(3,I) = LINEAR DISPLACEMENT (L UNITS)                        VINPUT
C                                                                        VINPUT
      ATAB(2,1) = VIPS                                                   VINPUT
      ATAB(3,1) = 0.0                                                    VINPUT
      DA1 = ADT/3.0                                                      VINPUT
      DA2 = ADT/12.0                                                     VINPUT
      UNITS = -G                                                         VINPUT
      DO 22 J=2,3                                                        VINPUT
      DO 21 I=2,NATAB,2                                                  VINPUT
      F1 = ATAB(J-1,I-1) * UNITS                                         VINPUT
      F2 = ATAB(J-1,I  ) * UNITS                                         VINPUT
      F3 = ATAB(J-1,I+1) * UNITS                                         VINPUT
      ATAB(J,I  ) = ATAB(J,I-1) + DA2*(5.0*F1+8.0*F2-F3)                 VINPUT
   21 ATAB(J,I+1) = ATAB(J,I-1) + DA1*(    F1+4.0*F2+F3)                 VINPUT
   22 UNITS = 1.0                                                        VINPUT
C                                                                        VINPUT
C     PRINT TABLES                                                       VINPUT
C                                                                        VINPUT
      WRITE (6,23) (UNITL,UNITT,UNITL,I=1,2)                             VINPUT
   23 FORMAT('0 UNIDIRECTIONAL VEHICLE POSITION TABLES'//                VINPUT
     *     2('       TIME        ACC        VELOCITY      POSITION    ')/  VINPUT
     *   2('      (MSEC)       (G)      (',A4,'/',A4,')',5X,'(',A4,')',4X)/)VINPUT
      DO 26 J=1,50                                                       VINPUT
      IF (J.GT.NATAB) GO TO 26                                           VINPUT
      T1 = (AT0 + DFLOAT(J-1)*ADT)*1000.0                                VINPUT
      IF (J+50.LE.NATAB) GO TO 25                                        VINPUT
      WRITE (6,24) T1,(ATAB(I,J),I=1,3)                                  VINPUT
   24 FORMAT(2(F11.5,F10.2,F13.4,F13.5,3X))                              VINPUT
      GO TO 26                                                           VINPUT
   25 T2 = (AT0 + DFLOAT(J+49)*ADT)*1000.0                               VINPUT
      WRITE (6,24) T1,(ATAB(I,J),I=1,3),T2,(ATAB(I,J+50),I=1,3)          VINPUT
   26 CONTINUE                                                           VINPUT
C                                                                        VINPUT
C     INITIALIZATION                                                     VINPUT
C                                                                        VINPUT
      DO 27 I=1,3                                                        VINPUT
      XACOMP(I) = -G*AX(I)*ATAB(1,1)                                     VINPUT
   27 XDOT0(I)= VIPS*AX(I)                                               VINPUT
   28 DO 30 I=1,3                                                        VINPUT
      DO 29 J=1,3                                                        VINPUT
   29 DVEH(I,J) = 0.0                                                    VINPUT
      DVEH(I,I) = 1.0                                                    VINPUT
      VMEGD(I) = 0.0                                                     VINPUT
   30 VMEG(I)   = 0.0                                                    VINPUT
      GO TO 64                                                           VINPUT
C                                                                        VINPUT
C     FOR OMNIDIRECTIONAL (6 DEGREES OF FREEDOM) VEHICLE MOTION          VINPUT
C     READ LINEAR DECELERATION AND ANGULAR ACCELERATION TABLES           VINPUT
C     FROM CARDS C.2.B AND C.4.                                          CHGIII
C                                                                        VINPUT
   31 MATAB = -NATAB                                                     VINPUT
```

```
      READ  (5,32)  LTYPE,LFIT,NPTS,(VMEG(I),I=1,3)                      VINPUT
   32 FORMAT (3I6,22X,3F10.0)                                            VINPUT
      IF (MATAB.GT.MXTAB3) STOP 80                                       MISC
      IF (LTYPE.EQ.2.AND.LFIT.LT.1) STOP 82                              CHGIII
      IF (LTYPE.EQ.1.AND.LFIT.LT.2) STOP 83                              VEHICL
      IF  (LTYPE.GT.0)  GO TO 34                                         VINPUT
      READ (5,33) ((ATAB(I,J),I=1,3),(ATAB(I,J),I=10,12),J=1,MATAB)      VINPUT
   33 FORMAT (10X,6F10.0)                                                VINPUT
      ISKIP = 0                                                          VINPUT
      GO TO 46                                                           VINPUT
C                                                                        CHGIII
C     FOR SPLINE FIT VEHICLE MOTION                                      CHGIII
C     READ DATA FROM CARDS C.5.                                          CHGIII
C                                                                        CHGIII
   34 LPTS = LTYPE-1 + NPTS                                              VINPUT
      IF (NPTS.GT.MXTAB3) STOP 81                                        MISC
      READ  (5,35)  (TT(I),(XYZ(I,J),J=1,6),I=1,LPTS)                    VINPUT
   35 FORMAT (7F10.0)                                                    VINPUT
      WRITE  (6,36)  LTYPE,LFIT,NPTS                                     CHGIII
   36 FORMAT ('0 SPLINE FIT TABULAR INPUT'//                             CHGIII
     *        3X,'LTYPE =',I6,'  LFIT =',I6,'  NPTS =',I6/)              CHGIII
      IF (LTYPE.EQ.2) WRITE(6,701) UNITL,UNITT,TT(1),(XYZ(1,J),J=1,6)    CHGIII
      IF (LTYPE.EQ.3) WRITE(6,702) UNITL,UNITT,TT(1),(XYZ(1,J),J=1,6),   CHGIII
     * UNITL,UNITT,UNITT,UNITT,TT(2),(XYZ(2,J),J=1,6)                    CHGIII
  701 FORMAT(32X ,'INITIAL LINEAR POSITION (',A4,')',17X,'INITIAL ANGULACHGIII
     *R POSITION (DEG)',/,3X,'TIME(',A4,')=',F9.4,3X,2('X=',F10.3,2X,    JTF984
     * 'Y=',F10.3,2X,'Z=',F10.3,8X),/)                                   CHGIII
  702 FORMAT(32X, 'INITIAL LINEAR POSITION (',A4,')',17X,'INITIAL ANGULACHGIII
     *R POSITION (DEG)',/,3X,'TIME(',A4,')=',F9.4,3X,2('X=',F10.3,2X,    JTF984
     * 'Y=',F10.3,2X,'Z=',F10.3,8X),/,30X,  'INITIAL LINEAR VELOCITY (',CHGIII
     * A4,'/',A4,')',12X,'INITIAL ANGULAR VELOCITY (DEG/',A4,')',        CHGIII
     */,3X,'TIME(',A4,')=',F9.4,3X,2('X=',F10.2,2X,'Y=',                 CHGIII
     * F10.2,2X,'Z=',F10.2,8X),/)                                        CHGIII
      IF (LTYPE.EQ.1) WRITE(6,703) UNITL,UNITT                           CHGIII
      IF (LTYPE.EQ.2) WRITE(6,704) UNITL,UNITT,UNITT,UNITT               CHGIII
      IF (LTYPE.EQ.3) WRITE(6,705) UNITT,UNITT                           VEHICL
  703 FORMAT(29X   ,'LINEAR POSITION (',A4,')',21X,'ANGULAR POSITION (DECHGIII
     *G)', /,5X,'TIME(',A4,')',11X,'X',11X,'Y',11X,'Z',18X,'YAW',8X,     VEHICL
     *'PITCH',8X,'ROLL')                                                 VEHICL
  704 FORMAT(26X,'LINEAR VELOCITY (',A4,'/',A4,')',16X,                  CHGIII
     * 'ANGULAR VELOCITY (DEG/',A4,')',/,5X,'TIME(',A4,')',              CHGIII
     * 11X,2('X',11X,'Y',11X,'Z',19X))                                   CHGIII
  705 FORMAT(26X,'LINEAR DECELERATION (G''S)',15X,                       VEHICL
     * 'ANGULAR ACCELERATION (DEG/',A4,'**2)',/,5X,'TIME(',A4,')',       CHGIII
     * 11X,2('X',11X,'Y',11X,'Z',19X))                                   CHGIII
      IF (LTYPE.EQ.1) WRITE(6,706) (TT(I),(XYZ(I,J),J=1,6),I=1,LPTS)     CHGIII
      IF (LTYPE.EQ.2) WRITE(6,706) (TT(I),(XYZ(I,J),J=1,6),I=2,LPTS)     CHGIII
      IF (LTYPE.EQ.3) WRITE(6,706) (TT(I),(XYZ(I,J),J=1,6),I=3,LPTS)     CHGIII
  706 FORMAT(1X,F12.5,6X,3F12.3,8X,3F12.3)                               CHGIII
      DO  37  I=1,3                                                      VINPUT
      X0(I) = XYZ(1,I)                                                   VINPUT
      XDOT0(I) = XYZ(2,I)                                                VINPUT
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```
      VMEG(I) = XYZ(2,I+3)                                              VINPUT
   37 ANGLE(I) = XYZ(1,I+3)                                             JTF984
       IMJ = 6                                                          JTF984
       IF(LTYPE.EQ.1)IMJ = 3                                            JTF984
      DO  45  II=1,IMJ                                                  JTF984
      CALL SPLINE (TT(LTYPE),XYZ(LTYPE,II),F,NPTS,LFIT)                 VINPUT
      I = II                                                            VINPUT
      IF  (II.GT.3)  I = II + 6                                         VINPUT
      IF(LTYPE.EQ.1) XDOTO(I) = F(3,1)                                  JTF984
      UNITS = 1.0                                                       JTF984
      IF  (LTYPE.LT.3 .AND. II.LE.3)  UNITS = -1.0/G                    VINPUT
      K1 = 1                                                            VINPUT
      DO  45  J=1,MATAB                                                 VINPUT
      TTT = ATO + DFLOAT(J-1)*ADT                                       VINPUT
      DO  39  L=K1,NPTS                                                 JTF984
       K = L                                                            JTF984
      IF  (TTT.LT.F(1,L+1))  GO TO 40                                   VINPUT
   39 CONTINUE                                                          VINPUT
   40 K1 = K                                                            VINPUT
      DX = TTT - F(1,K)                                                 VINPUT
      IF (LTYPE-2)  41,42,43                                            BUTLER1
   41 ACC = 2.0*F(4,K) + 6.0*DX*F(5,K)                                  VINPUT
      GO TO 44                                                          VINPUT
   42 ACC = F(3,K) + DX*(2.0*F(4,K)+3.0*DX*F(5,K))                      VINPUT
      GO TO 44                                                          VINPUT
   43 ACC = F(2,K) + DX*(F(3,K)+DX*(F(4,K)+DX*F(5,K)))                  VINPUT
   44 ATAB(I,J) = ACC*UNITS                                             VINPUT
   45 CONTINUE                                                          VINPUT
      ISKIP = 1                                                         VINPUT
       IF(LTYPE.NE.1)GO TO 46                                           JTF984
C     CODE FOR OMEGA ROUTINE: COMPUTE ATAB(I,J),I=10,11,12 J = 1,MATAB  JTF984
      DO 80 I = 1,NPTS                                                  JTF984
       DO 91 K = 1,3                                                    JTF984
   91  A1(K) = XYZ(I,K+3)                                               JTF984
      CALL QUAT(A1,W1)                                                  JTF984
       DO 76 K = 1,4                                                    JTF984
   76 Q1(I,K) = W1(K)                                                   JTF984
      IF(I.EQ.1)GO TO 80                                                JTF984
       TA = 0.0                                                         JTF984
       TB = 0.0                                                         JTF984
      DO 77 K = 1,4                                                     JTF984
      TA = TA + DABS(Q1(I,K) - Q1(I-1,K))                               JTF984
   77 TB = TB + DABS(Q1(I,K) + Q1(I-1,K))                               JTF984
       IF(TA.LE.TB)GO TO 80                                             JTF984
       DO 78 K = 1,4                                                    JTF984
   78  Q1(I,K) = -Q1(I,K)                                               JTF984
   80  CONTINUE                                                         JTF984
       DO 82 K = 1,4                                                    JTF984
   82  CALL SPLINE(TT,Q1(1,K),SP(1,1,K),NPTS,LFIT)                      JTF984
       DO 90 J = 1,MATAB                                                JTF984
       TTT = ATO + DFLOAT(J-1)*ADT                                      JTF984
       K1 = 1                                                           JTF984
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      DO 83 L = K1,NPTS                                                 JTF984
      K = L                                                             JTF984
   83 IF(TTT.LT.SP(1,L+1,1))GO TO 84                                    JTF984
   84 K1 = K                                                            JTF984
      DX = TTT - SP(1,K,1)                                              JTF984
      DO 85 L = 1,4                                                     JTF984
      W1(L) = SP(2,K,L)+DX*(SP(3,K,L)+DX*(SP(4,K,L)+DX*SP(5,K,L)))      JTF984
      QD(L) = 2.0*SP(4,K,L) + 6.0*DX*SP(5,K,L)                          JTF984
   85 IF(J.EQ.1)QC(L) = SP(3,K,L)+DX*(2.0*SP(4,K,L)+DX*3.0*SP(5,K,L))   MISC
      CCC = 2.0/RADIAN                                                  JTF984
      IF(J.GT.1)GO TO 88                                                JTF984
     CALL CROSS(QC(2),W1(2),A1)                                         JTF984
      DO 86 K = 1,3                                                     JTF984
   86 VMEG(K) = CCC*(W1(1)*QC(K+1) - QC(1)*W1(K+1) + A1(K))             JTF984
      CALL DRCQUA(DVEH,W1)                                              JTF984
      CALL YPRDEG(DVEH,ANGLE)                                           JTF984
   88 CALL CROSS(QD(2),W1(2),QC(2))                                     JTF984
      DO 89 K = 2,4                                                     JTF984
   89 ATAB(K+8,J) = CCC*(W1(1)*QD(K)-QD(1)*W1(K) + QC(K))               JTF984
   90 CONTINUE                                                          JTF984
   46 DO  55  J=1,MATAB                                                 VINPUT
      IF (MOD(J,45).NE.1) GO TO 49                                      VINPUT
C                                                                       VINPUT
C     PRINT PAGE HEADING AT START OF EACH 45 TIME POINTS.               VINPUT
C                                                                       VINPUT
      IPAGE = (J-1)/45 + 1                                              VINPUT
      IF (ISKIP.EQ.1) WRITE (6,75) NPG                                  PAGE
      IF (ISKIP.EQ.1) NPG=NPG+1                                         PAGE
   75 FORMAT('1',122X,'PAGE',I5)                                        PAGE
      WRITE (6,48) VPSTTL,IPAGE,UNITL,UNITT,UNITL                       PAGE
   48 FORMAT('0  VEHICLE LINEAR TIME HISTORY',3X,20A4,3X,               PAGE
     *           'PAGE NO.',I3//                                        VINPUT
     *       4X,'TIME',12X,'LINEAR DECELERATIONS (G''S)',               VINPUT
     *                 11X,'LINEAR VELOCITIES (',A4,'/',A4,')',         VINPUT
     *                 11X,'LINEAR DISPLACEMENTS (',A4,')'    /         VINPUT
     *        3X,'(MSEC)',3(11X,'X',11X,'Y',11X,'Z',3X)     /  )        VINPUT
      ISKIP = 1                                                         VINPUT
   49 IF (J.GT.1) GO TO 52                                              VINPUT
C                                                                       VINPUT
C     INTEGRATION INITIALIZATION FOR TIME = 0.                          VINPUT
C                                                                       VINPUT
      DO 50 I=1,3                                                       VINPUT
      ATAB(I+6,J) = X0(I)                                               VINPUT
   50 ATAB(I+12,J) = VMEG(I)                                            JTF984
      CALL DRCYPR (DVEH,ANGLE,IDYPR)                                    VINPUT
      DO 51 I=1,3                                                       VINPUT
      IF (LTYPE.EQ.0)  XDOT0(I) = VIPS*DVEH(1,I)                        VINPUT
   51 ATAB(I+3,J) = XDOT0(I)                                            VINPUT
      GO TO 54                                                          VINPUT
   52 DO 53 I=1,3                                                       VINPUT
C                                                                       VINPUT
C     INTEGRATE LINEAR VELOCITY AND DISPLACEMENT.                       VINPUT
```

```
C                                                                        VINPUT
      ATAB(I+3,J) = ATAB(I+3,J-1)-G*ADT/2.0*(ATAB(I,J-1)+ATAB(I,J))     VINPUT
   53 ATAB(I+6,J) = ATAB(I+6,J-1)                                        VINPUT
     *    +ADT*(ATAB(I+3,J-1)-G*ADT/6.0*(2.0*ATAB(I,J-1)+ATAB(I,J)))    VINPUT
   54 T1 = (AT0 + DFLOAT(J-1)*ADT)*1000.0                                VINPUT
   55 WRITE(6,56) T1,(ATAB(I,J),I=1,9)                                   VINPUT
   56 FORMAT(F9.3,3(3X,3F12.3))                                          VINPUT
      DO 61 J=1,MATAB                                                    VINPUT
      IF (MOD(J,45).NE.1) GO TO 58                                       VINPUT
C                                                                        VINPUT
C     PRINT PAGE HEADING AT START OF EACH 45 TIME POINTS.                VINPUT
C                                                                        VINPUT
      IPAGE = (J-1)/45 + 1                                               VINPUT
      WRITE (6,57) VPSTTL,NPG,IPAGE,UNITT,UNITT                          PAGE
      NPG=NPG+1                                                          PAGE
   57 FORMAT('1 VEHICLE ANGULAR TIME HISTORY',3X,20A4,10X,'PAGE',I5/     PAGE
     *       116X,'PAGE NO.',I3/                                         PAGE
     *        4X,'TIME', 7X,'ANGULAR ACCELERATIONS (DEG/',A4,'**2)',     VINPUT
     *                   7X,'ANGULAR VELOCITIES (DEG/',A4,')',           VINPUT
     *                  11X,'ANGULAR DISPLACEMENTS (DEG)' /              VINPUT
     *       3X,'(MSEC)',2(11X,'X',11X,'Y',11X,'Z',3X),                  VINPUT
     *       10X,'YAW',8X,'PITCH',8X,'ROLL' /)                           VINPUT
   58 IF(J.EQ.1) GO TO 60                                                VINPUT
C                                                                        VINPUT
C     INTEGRATE ANGULAR VELOCITY AND DISPLACEMENT.                       VINPUT
C                                                                        VINPUT
      DO 59 I=1,3                                                        VINPUT
      ATAB(I+12,J) = ATAB(I+12,J-1)+(ATAB(I+9,J-1)+ATAB(I+9,J))*ADT/2.0 VINPUT
   59 THET(I) = ADT*(ATAB(I+12,J-1)+(2.0*ATAB(I+9,J-1)+ATAB(I+9,J))*ADT VINPUT
     */6.0)*RADIAN                                                       VINPUT
      CALL DSETD(DVEH,THET,THT)                                          VINPUT
   60 CALL YPRDEG(DVEH,THET)                                             VINPUT
      T1 = (AT0 + DFLOAT(J-1)*ADT)*1000.0                                VINPUT
   61 WRITE (6,56)  T1,(ATAB(I,J),I=10,15),THET                          VINPUT
C                                                                        VINPUT
C     PROGRAM INITIALIZATION FOR TIME = 0.                               VINPUT
C                                                                        VINPUT
      CALL DRCYPR (DVEH,ANGLE,IDYPR)                                     VINPUT
      DO 63 I=1,3                                                        VINPUT
      XACOMP(I) = -G*ATAB(I,1)                                           VINPUT
      VMEG(I)  = ATAB(I+12,1)*RADIAN                                     VINPUT
   63 VMEGD(I) = ATAB(I+9 ,1)*RADIAN                                     VINPUT
   64 J = MSEG                                                           VINPUT
      IF  (MSEG.EQ.0)  GO TO 65                                          VINPUT
      IF  (MSEG.LE.NSEG)  GO TO 66                                       VINPUT
      IF  (MSEG.NE.NVEH+1)  STOP 6                                       VINPUT
   65 NVEH = NVEH+1                                                      VINPUT
      J = NVEH                                                           VINPUT
C                                                                        VINPUT
C     SETUP FOR ALL PRESCRIBED SEGMENT MOTION.                           VINPUT
C                                                                        VINPUT
   66 NVH = NVH+1                                                        VINPUT
```

```
      ISING(J) = -1                                                     VINPUT
      IF  (MSEG.GT.NSEG)  SEG(J) = VEH(NVH)                             VINPUT
      RW(J) = 0.0                                                       VINPUT
      DO  67  I=1,3                                                     VINPUT
      RPHI (I,J) = 0.0                                                  VINPUT
      SEGLA(I,J) = VMEGD(I)                                             VINPUT
      WMEGD(I,J) = XACOMP(I)                                            VINPUT
   67 AXV(I,NVH) = AX(I)                                                VINPUT
      VTO(NVH) = ATO                                                    VINPUT
      VDT(NVH) = ADT                                                    VINPUT
      OMEGV(NVH) = OMEG                                                 VINPUT
      TIMEV(NVH) = VTIME                                                VINPUT
      NVTAB(NVH) = NATAB                                                VINPUT
      INDXV(NVH) = J                                                    VINPUT
      NJ = IABS(NATAB)                                                  VINPUT
      IF  (NJ.LE.0)  GO TO 69                                           VINPUT
      DO  68  K=1,NJ                                                    VINPUT
      DO  68  I=1,3                                                     VINPUT
      VATAB(I   ,K,NVH) = ATAB(I,K)                                     VINPUT
   68 VATAB(I+3,K,NVH) = ATAB(I+9,K)                                    VINPUT
   69 IF  (J.LE.NSEG)  GO TO 72                                         VINPUT
C                                                                       VINPUT
C     SETUP FOR NEW VEHICLE (SEGMENT) MOTION.                           VINPUT
C                                                                       VINPUT
      W(J)  = 0.0                                                       VINPUT
      RW(J) = 0.0                                                       VINPUT
      DO  71  I=1,3                                                     VINPUT
      DO  70  K=1,3                                                     VINPUT
      D(I,K,J) = DVEH(I,K)                                              VINPUT
   70 SGTEST(I,K,J) = 0.0                                               VINPUT
      SGTEST(I,4,J) = 0.0                                               VINPUT
      SEGLP(I,J) = XO(I)                                                VINPUT
      SEGLV(I,J) = XDOTO(I)                                             VINPUT
      WMEG (I,J) = VMEG(I)                                              VINPUT
      PHI  (I,J) = 0.0                                                  VINPUT
   71 RPHI (I,J) = 0.0                                                  VINPUT
   72 IF  (MSEG.NE.0)  GO TO 12                                         VINPUT
      SEG(NVEH) = VEH(6)                                                VINPUT
C                                                                       VINPUT
C     SET UP SEGMENT DATA FOR GROUND                                    VINPUT
C                                                                       VINPUT
      NGRND = NVEH+1                                                    VINPUT
      IF  (NGRND.GT.30 .OR. NVH.GT.6)  STOP 7                           VINPUT
      SEG(NGRND) = GRND                                                 VINPUT
      J = NGRND                                                         VINPUT
      ISING(J) = -1                                                     VINPUT
      W(J)  = 0.0                                                       VINPUT
      RW(J) = 0.0                                                       VINPUT
      DO  74  I=1,3                                                     VINPUT
      DO  73  K=1,3                                                     VINPUT
      D(I,K,J) = 0.0                                                    VINPUT
   73 SGTEST(I,K,J) = 0.0                                               VINPUT
```

```
      D(I,I,J) = 1.0                                                    VINPUT
      SGTEST(I,4,J) = 0.0                                               VINPUT
      SEGLP(I,J) = 0.0                                                  VINPUT
      SEGLV(I,J) = 0.0                                                  VINPUT
      SEGLA(I,J) = 0.0                                                  VINPUT
      WMEG (I,J) = 0.0                                                  VINPUT
      WMEGD(I,J) = 0.0                                                  VINPUT
      PHI  (I,J) = 0.0                                                  VINPUT
   74 RPHI (I,J) = 0.0                                                  VINPUT
      RETURN                                                            VINPUT
      END                                                               VINPUT
```

```
      DOUBLE PRECISION FUNCTION VISCOS(ZD,VISC,HA)                      VISCOS
C                                                 REV 19    10/23/78VISCOS
C     COMPUTES SUM OF COULOMB AND VISCOUS TORQUES                       VISCOS
C     AT JOINTS AS A FUNCTION OF THETA DOT.                             VISCOS
C     ACTUALLY ROUTINE RETURNS SUM/ZD.                                  VISCOS
C                                                                       VISCOS
C         ARGUMENTS:                                                    VISCOS
C          ZD  : !THETA DOT! WHERE THETA IS THE ANGLE OF THE JOINT.     VISCOS
C          VISC: ARRAY OF 5 VALUES DESCRIBING FUNCTION EVALUATION.      VISCOS
C                                                                       VISCOS
      IMPLICIT REAL*8 (A-H,O-Z)                                         VISCOS
      DIMENSION VISC(5)                                                 VISCOS
      Z = ZD                                                            VISCOS
      IF (ZD.LT.VISC(3)) Z = VISC(3)/(2.0-ZD/VISC(3))                   VISCOS
      HA = (Z-ZD)/Z                                                     VISCOS
      VISCOS = VISC(1)+VISC(2)/Z                                        VISCOS
      RETURN                                                            VISCOS
      END                                                               VISCOS
```

```
      SUBROUTINE VISPR(IJ,NJ)                                           VISPR
C                                                    REV IV    02/01/88MISDOT
C     COMPUTES VISCOS AND SPRING TORQUES AT THE JOINTS                  VISPR
C     AND ADDS THEM TO THE U2 ARRAY.                                    VISPR
C                                                                       VISPR
C     ARGUMENTS:                                                        VISPR
C        NJ = 0 - REGULAR COMPUTATION FOR ALL JOINTS                    VISPR
C           # 0 - COMPUTE ONLY FOR JOINT NJ IMPULSE                     VISPR
C                                                                       VISPR
C        IJ = 1 IMPULSE FOR FLEXURE ONLY                                VISPR
C           = 2 IMPULSE FOR TORSION ONLY                                VISPR
C           = 4 IMPULSE FOR GLOBALGRAPHIC ONLY                          VISPR
C                                                                       VISPR
      IMPLICIT REAL*8 (A-H,O-Z)                                         VISPR
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,           VISPR
     *               NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG    PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),VISPR
     *               SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)       VISPR
      COMMON/DESCRP/ PHI(3,30),W(30),RW(30),SR(4,60),HA(3,60),HB(3,60), SLIP
     *               RPHI(3,30),HT(3,3,60),SPRING(5,90),VISC(7,90),     VISPR
     *               JNT(30),IPIN(30),ISING(30),IGLOB(30),JOINTF(30)    VISPR
      COMMON/CMATRX/ V1(3,30),V2(3,30),V3(3,12),B12(3,3,60),A22(3,3,60),VISPR
     *               F(3,30),TQ(3,30),WJ(30),A11(3,3,30)                SLIP
      COMMON/FORCES/PSF(7,70),BSF(4,20),SSF(10,40),BAGSF(3,20),         NCFORC
     *               PRJNT(7,30),NPANEL(5),NPSF,NBSF,NSSF,NBGSF         VISPR
      COMMON/CEULER/ IEULER(30),HIR(3,3,90),ANG(3,30),ANGD(3,30),       JDRIFT
     *               FE(3,30),TQE(3,30),CONST(5,30)                     JDRIFT
      COMMON/TEMPVI/ CREST,TTI(3),R1I(3),R2I(3),JSTOP(4,2,30)           VISPR
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         VISPR
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      COMMON/TEMPVS/ T3(3),T6(3),T7(3),T8(3),T9(3),                     VISPR
     *               WIJ(3),ANGL(3),DH1(3,3),HD3(3,3),                  VISPR
     *               HAD,HBD,WIJM,CV,CSA,CSB,TQC,DMMY(35067)            80386
      IF (NJNT.LE.0) GO TO 99                                           VISPR
      CALL ELTIME(1,13)                                                 VISPR
      IF (NPRT(12).NE.0) WRITE (6,11)  TIME,NPG                         PAGE
      IF (NPRT(12).NE.0) NPG=NPG+1                                      PAGE
   11 FORMAT('1 VISPR COMPUTATIONS FOR TIME =',F12.6,80X,'PAGE',I5)     PAGE
      J1 = 1                                                            VISPR
      J2 = NJNT                                                         VISPR
      IF (NJ.EQ.0) GO TO 13                                             VISPR
      J1 = NJ                                                           VISPR
      J2 = NJ                                                           VISPR
   13 DO 90 J=J1,J2                                                     VISPR
      DO 12 L=1,3                                                       VISPR
      T3(L) = 0.0                                                       VISPR
      T6(L) = 0.0                                                       VISPR
      ANGL(L) = 0.0                                                     VISPR
   12 TQ(L,J) = 0.0                                                     VISPR
      WJ(J) = 0.0                                                       VISPR
C                                                                       VISPR
C     DO NOT COMPUTE TORQUES FOR NULL, LOCKED OR EULER JOINTS.          VISPR
```

```
C                                                                        VISPR
      I = IABS(JNT(J))                                                   VISPR
      IF (I.LE.0) GO TO 90                                               VISPR
      CALL DOT33 (D(1,1,J+1),HT(1,1,2*J),HIR(1,1,J))                     VISPR
      IF  (IABS(IPIN(J)).EQ.4)  GO TO 90                                 SLIP
C                                                                        VISPR
C     ZERO T1-T9 ARRAYS AND HAD,HBD,WIJM,CV,CS4,CSB AND TQC.             VISPR
C                                                                        VISPR
      WIJM = 0.0                                                         VISPR
      HAC = 0.0                                                          BUTLER1
      CV   = 0.0                                                         VISPR
      CSA  = 0.0                                                         VISPR
      CSB  = 0.0                                                         VISPR
      TQC  = 0.0                                                         VISPR
      CALL DOT33 (D(1,1,I),HT(1,1,2*J-1),DH1)                            VISPR
      CALL DOT33 (DH1,HIR(1,1,J),HD3)                                    VISPR
      DO 220 L=1,3                                                       TGMOD6
      DO 220 K=1,3                                                       TGMOD6
      IF(DABS(HD3(L,K)).LT.EPS(10)) HD3(L,K) = 0.D0                      TGMOD6
  220 CONTINUE                                                           TGMOD6
      HAD  = HD3(3,3)                                                    VISPR
      IF  (HAD.GT. 1.0)  HAD =  1.0                                      VISPR
      IF  (HAD.LT.-1.0)  HAD = -1.0                                      VISPR
      ANGL(1) = DACOS(HAD)                                               VISPR
      IF ((HD3(2,3).NE.0.0 .OR. HD3(1,3).NE.0.0).AND.IABS(IPIN(J)).NE.7)SLIP
     *ANGL(2) = DATAN2(HD3(2,3),HD3(1,3))                                VISPR
      ANGL(3) = DATAN2(HD3(2,1)-HD3(1,2),HD3(1,1)+HD3(2,2))              VISPR
      IF(NPRT(12).NE.0.AND.IPIN(J).LT.0) WRITE (6,739) J,I,ANGL,         TGMOD6
     *((D(L,K,J+1),K=1,3),(HT(L,K,2*J),K=1,3),(HIR(L,K,J),K=1,3),L=1,3),TGMOD6
     *((D(L,K,I),K=1,3),(HT(L,K,2*J-1),K=1,3),(DH1(L,K),K=1,3),L=1,3),   TGMOD6
     *         ((HD3(L,K),K=1,3),L=1,3)                                  TGMOD6
  739 FORMAT(1H0,'J= ',I2,1X,'I= ',I2,3(2X,D14.7),/,                     TGMOD6
     *       2(3(9(1X,D13.6),/),/),3(3(2X,D18.12),/))                    TGMOD6
      IF  (IPIN(J).LT.0)  GO TO 41                                       VISPR
      IF (NJ.NE.0.AND.IJ.EQ.4) GO TO 27                                  VISPR
C                                                                        VISPR
C     CONVERT TO INERTIAL REFERENCE SYSTEM                               VISPR
C        T1= D(I)'*HA(NJ)      T4=D(J+1)'*HA(MJ)                         VISPR
C        T3= D(I)'*WMEG(I)     T6=D(J+1)'*WMEG(J+1)                      VISPR
C                                                                        VISPR
C     HAD = COS TA = T1.T4                                               VISPR
C     WIJ = T3-T6                                                        VISPR
C     WJ  = !WIJ!                                                        VISPR
C                                                                        VISPR
      DO 20 L=1,3                                                        VISPR
      DO 15 M=1,3                                                        VISPR
      T3(L) = T3(L)+ D(M,L,I)* WMEG(M,I)                                 VISPR
   15 T6(L) = T6(L)+ D(M,L,J+1)* WMEG(M,J+1)                             VISPR
      WIJ(L)= T3(L)-T6(L)                                                VISPR
   20 WIJM = WIJM + WIJ(L)**2                                            VISPR
      WIJM = DSQRT(WIJM)                                                 VISPR
      IF (WIJM.LE.EPS(12)) WIJM = 0.0                                    MISDOT
```

```
      WJ(J) = WIJM                                                      VISPR
C                                                                       VISPR
C     T7 = T1 X T4                                                      VISPR
C     HAC = !T7!                                                        VISPR
C                                                                       VISPR
      CALL CROSS (DH1(1,3),HIR(1,3,J),T7)                               VISPR
      HACC = T7(1)**2 + T7(2)**2 + T7(3)**2                             VISPR
      HAC = DSQRT(HACC)                                                 VISPR
C                                                                       VISPR
C     COMPUTE CV, THE MAGNITUDE OF VISCOUS AND COULOMB TORQUE/WIJM      VISPR
C             RA = +SGN TA DOT = -WIJ.T7                                VISPR
C        AND CSA, THE MAGNITUDE OF FLEXURE TORQUE/HAC                   VISPR
C                                                                       VISPR
      CV = VISCOS(WIJM,VISC(1,3*J-2),HA2)                               VISPR
      IF  (NJ.EQ.0)  HA(2,2*J) = HA2                                    VISPR
      CREST = VISC(7,3*J-2)                                             VISPR
      RA = -(WIJ(1)*T7(1) + WIJ(2)*T7(2) + WIJ(3)*T7(3))                VISPR
      IF (HAC.LT.EPS(12)) RA=0.0                                        MISDOT
      IF (HAC.GE.EPS(12)) RA=RA/HAC                                     MISDOT
      JSTP = 0                                                          VISPR
      IF (IPIN(J).EQ.7) GOTO 25                                         SLIP
      IF (JOINTF(J).EQ.0) CSA = EFUNCT(ANGL(1),RA,SPRING(1,3*J-2),JSTP) VISPR
      IF (JOINTF(J).NE.0) CSA = FNTERP(ANGL(1),ANGL(2),JOINTF(J))       VISPR
      IF (HAC.LT.EPS(12)) CSA=0.0                                       MISDOT
      IF (HAC.GE.EPS(12)) CSA=CSA/HAC                                   MISDOT
25    IF (NJ.EQ.0) JSTOP(1,1,J) = JSTP                                  SLIP
      IF (IPIN(J).EQ.1) GO TO 34                                        VISPR
      IF (IPIN(J).EQ.6) GOTO 34                                         SLIP
C                                                                       VISPR
C     RB = +SGN TB DOT = -WIJ.T8                                        VISPR
C     COMPUTE CSB, THE MAGNITUDE OF TORSIONAL TORQUE/HBC                VISPR
C                                                                       VISPR
      RB  = -(WIJ(1)*HIR(1,3,J) + WIJ(2)*HIR(2,3,J) + WIJ(3)*HIR(3,3,J))VISPR
      CSB = EFUNCT(ANGL(3),RB,SPRING(1,3*J-1),JSTP)                     VISPR
      IF (NJ.EQ.0) JSTOP(2,1,J) = JSTP                                  VISPR
      IF (NJ.GT.0) GO TO 34                                             VISPR
C                                                                       VISPR
C     COMPUTE EFFECT OF GLOBALGRAPHIC JOINT STOP (IPIN=3)               VISPR
C                                                                       VISPR
   27 IF (IPIN(J).NE.3) GO TO 34                                        VISPR
      CALL GLOBAL (J,HD3(1,3),DH1,TQC,T9,ANGL)                          VISPR
C                                                                       VISPR
C     COMPUTE TOTAL TORQUE IN INERTIAL REFERENCE BY                     VISPR
C     TQ = -CV*WIJ + CSA*T7 + CSB*T8 + TQC*T9                           VISPR
C                                                                       VISPR
   34 IF (NJ.EQ.0) GO TO 35                                             JDRIFT
      CV = 0.0                                                          VISPR
      IF (IJ.NE.1) CSA = 0.0                                            VISPR
      IF (IJ.NE.2) CSB = 0.0                                            VISPR
      IF (IJ.NE.4) TQC = 0.0                                            VISPR
   35 IF (HA(2,2*J).EQ.0.0) GO TO 36                                    JDRIFT
      CALL MAT31 (HIR(1,1,J),HA(1,2*J-1),TQ(1,J))                       VISPR
```

```
      DO 38 L=1,3                                                       VISPR
   38 TQ(L,J) = HA(2,2*J)*TQ(L,J)                                       VISPR
   36 DO 37 L=1,3                                                       VISPR
      TQ(L,J) = TQ(L,J) -CV*WIJ(L) +CSA*T7(L) +CSB*HIR(L,3,J) +TQC*T9(L)VISPR
   37 TTI(L) = TQ(L,J)                                                  VISPR
      IF (NPRT(12).NE.0) WRITE (6,39)                                   VISPR
     *        J,CV,CSA,CSB,HAC,RA,RB,(TQ(L,J),L=1,3),                   VISPR
     *        WIJ,T7,ANGL, DH1 , HD3,                                   VISPR
     *        ((HIR(L,K,J),L=1,3),K=1,3)                                VISPR
   39 FORMAT (1H0,I3,3F14.3,6F14.6/(4X,9F14.6))                         VISPR
C                                                                       VISPR
C     ADD TORQUE CONVERTED TO LOCAL REFERENCE BY                        VISPR
C      U2I = U2I + DI*TQ                                                VISPR
C      U2J = U2J - DJ*TQ                                                VISPR
C                                                                       VISPR
      DO 40 L=1,3                                                       VISPR
      DO 40 M=1,3                                                       VISPR
      U2(L,I  ) = U2(L,I  ) + D(L,M,I  )*TQ(M,J)                        VISPR
   40 U2(L,J+1) = U2(L,J+1) - D(L,M,J+1)*TQ(M,J)                        VISPR
C                                                                       VISPR
C     STORE DATA FOR OUTPUT ROUTINE INTO PRJNT ARRAY.                   VISPR
C                                                                       VISPR
   41 PRJNT(1,J) = IPIN(J)                                              VISPR
      PRJNT(2,J) = ANGL(1)                                              VISPR
      PRJNT(3,J) = ANGL(2)                                              VISPR
      PRJNT(4,J) = ANGL(3)                                              VISPR
      PRJNT(5,J) = (CSA*HAC)**2 + CSB**2                                VISPR
      PRJNT(6,J) = (CV*WIJM)**2                                         VISPR
      PRJNT(7,J) = TQ(1,J)**2 + TQ(2,J)**2 + TQ(3,J)**2                 VISPR
   90 CONTINUE                                                          VISPR
      CALL ELTIME(2,13)                                                 VISPR
   99 RETURN                                                            VISPR
      END                                                               VISPR
```

```
      SUBROUTINE WINDY(MMM,MM,N,NN,NT)                                    WINDY
C                                                      REV IV    07/23/86TWOPI
C     COMPUTES FORCES AND TORQUES ADDING THEM TO THE U1 AND U2 ARRAYS     WINDY
C     OF WIND BLAST FORCES DETERMINED BY FUNCTION STORED IN TAB(NT)       WINDY
C     ON ELLIPSOID (MM) ATTACHED TO BODY SEGMENT (M) WHICH EXTENDS        WINDY
C     THROUGH THE INTERSECTING PLANE (NN) ATTACHED TO SEGMENT (N).        WINDY
C                                                                         WINDY
       IMPLICIT REAL*8 (A-H,O-Z)                                          WINDY
      COMMON/CONTRL/ TIME,NSEG,NJNT,NPL,NBLT,NBAG,NVEH,NGRND,             WINDY
     *              NS,NQ,NSD,NFLX,NHRNSS,NWINDF,NJNTF,NPRT(36),NPG       PAGE
      COMMON/SGMNTS/ D(3,3,30),WMEG(3,30),WMEGD(3,30),U1(3,30),U2(3,30),WINDY
     *              SEGLP(3,30),SEGLV(3,30),SEGLA(3,30),NSYM(30)          WINDY
      COMMON/TABLES/MXNTI,MXNTB,MXTB1,MXTB2,NTI(50),NTAB(1250),TAB(4500)DIMENB
      COMMON/WINDFR/ WTIME(30),QFU(3,5),QFV(3,5),WF(3,30),IWIND(30),      WINDOP
     *              MWSEG(7,30),NFVSEG(6),NFVNT(5),MOWSEG(30,30)          WINDOP
      COMMON/CNTSRF/ PL(24,30),BELT(20,8),TPTS(6,8),BD(24,40)             EDGE
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                           WINDY
     *              UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                     TWOPI
      COMMON/TEMPVS/ DMNT(3,3),XMN(3),XMM(3),TM(3),BET,BTS,P,FT(3),       WINDOP
     *              FF(3),AF(3),FAF,TF,BREF,SCALE,TRACER,AREA,RLM(3),     WINDOP
     *              TQM(3),RM(3),DD(3,3),DDD(3,3),R(3,3),DVP(3,3),        WINDOP
     *              SI(3,15),R2(2,3),TTF(3),FFT(3),AM(3,3),VP(3),         WINDOP
     *              SS(3),SM(3),SN1(3),AS(3),BTE,XNORM,TEMP,              WINDOP
     *              X,Y,AI(3,3,15),RYC,AMDA1,AMDA2,B1,B2,RXC              WINDOP
     *             ,DMMY(34805)                                           80386
C                                                                         WINDOP
C     MMM=0   CALCULATE NFORCE                                            WINDOP
C     MMM>0   WIND FORCE CALCULATED USING ENTIRE AREA METHOD              WINDOP
C     MMM<0   WIND FORCE CALCULATED USING GRID METHOD                     WINDOP
C                       (ALLOWS BLOCKING SEGMENTS)                        WINDOP
C                                                                         WINDOP
      DATA NSTEPS/4/                                                      WINDOP
      CALL ELTIME(1,37)                                                   WINDY
      M=IABS(MMM)                                                         WINDOP
      IF (MMM.EQ.0) GO TO 50                                              WINDOP
C                                                                         WINDY
C     COMPUTE PENETRATION DISTANCE; IF NEGATIVE, RETURN.                  WINDY
C                                                                         WINDY
      CALL DOTT33 (D(1,1,M),D(1,1,N),DMNT)                                WINDY
      DO 10 I=1,3                                                         WINDY
   10 XMN(I) = SEGLP(I,M) - SEGLP(I,N)                                    WINDY
      CALL MAT31 (D(1,1,M),XMN,XMM)                                       WINDY
      CALL MAT31 (DMNT,PL(1,NN),TM)                                       WINDY
      BET = PL(4,NN)                                                      WINDY
      DO 11 I=1,3                                                         WINDY
   11 BET = BET - TM(I)*(BD(I+3,MM)+XMM(I))                               WINDY
      CALL MAT31 (BD(16,MM),TM,RM)                                        WINDY
      BTS = TM(1)*RM(1) + TM(2)*RM(2) + TM(3)*RM(3)                       WINDY
      BTE = -DSQRT(BTS)                                                   WINDY
      P   = BET - BTE                                                     WINDY
      IF (P.LT.0.0) GO TO 99                                              WINDY
C                                                                         WINDY
```

```
C     FETCH OR STORE INITIAL PENETRATION TIME.                    WINDY
C                                                                 WINDY
      IWIND(M) = M                                                WINDY
      IF (TIME.LE.WTIME(M)) WTIME(M) = TIME                       WINDY
      FTIME = TIME - WTIME(M)                                     WINDY
C                                                                 WINDY
C     GET DRAG COEFFICIENT CD FROM TABLE NTC FOR TIME = FTIME.    WINDOP
C                                                                 WINDOP
      CD=1.0                                                      WINDOP
      NTC=MWSEG(6,M)                                              WINDOP
      IF (NTC.EQ.0) GOTO 20                                       WINDOP
      KT=NTI(NTC)                                                 WINDOP
      NENTRY=TAB(KT+5)                                            WINDOP
      K1=KT+10                                                    WINDOP
      K2=4*NENTRY+KT+2                                            WINDOP
      IF (NENTRY.EQ.1) GOTO 18                                    WINDOP
      DO 17 K=K1,K2,4                                             WINDOP
      IF (FTIME.GT.TAB(K)) GOTO 17                                WINDOP
      KK=K                                                        WINDOP
      R1=(TAB(K)-FTIME)/(TAB(K)-TAB(K-4))                         WINDOP
      GOTO 19                                                     WINDOP
17    CONTINUE                                                    WINDOP
18    KK=K2                                                       WINDOP
      R1=0.0                                                      WINDOP
19    R22=1.0-R1                                                  WINDOP
      K=KK+1                                                      WINDOP
      CD=R22*TAB(K)+R1*TAB(K-4)                                   WINDOP
C                                                                 WINDOP
C     GET FORCE VECTOR FT                                         WINDOP
C                                                                 WINDOP
C          RK=0   TIME DEPENDENT WIND FORCE FROM TABLE            WINDOP
C          RK#0   VELOCITY DEPENDENT WIND FORCE                   WINDOP
C                                                                 WINDOP
20    KT = NTI(NT)                                                WINDOP
      RK=TAB(KT)                                                  WINDOP
      IF (RK.EQ.0.0) GOTO 13                                      WINDOP
      C=TAB(KT+1)                                                 WINDOP
      PR=TAB(KT+2)                                                WINDOP
      NSV=IDINT(TAB(KT+3))                                        WINDOP
      NSR=IDINT(TAB(KT+4))                                        WINDOP
      DO 12 I=1,3                                                 WINDOP
      V=SEGLV(I,NSV)-SEGLV(I,NSR)                                 WINDOP
12    FT(I)=DSIGN(0.5D0,-V)*CD*RK*PR*V**2/C**2                    WINDOP
      GOTO 14                                                     WINDOP
13    NSR=IDINT(TAB(KT+4))                                        WINDOP
      NENTRY = TAB(KT+5)                                          WINDY
      K1 = KT+10                                                  WINDY
      K2 = 4*NENTRY + KT+2                                        WINDY
      IF (NENTRY.EQ.1) GO TO 31                                   WINDY
      DO 30 K=K1,K2,4                                             WINDY
      IF (FTIME.GT.TAB(K)) GO TO 30                               WINDY
      KK = K                                                      WINDY
```

```
      R1 = (TAB(K)-FTIME)/(TAB(K)-TAB(K-4))                            WINDY
      GO TO 32                                                         WINDY
   30 CONTINUE                                                         WINDY
   31 KK = K2                                                          WINDY
      R1 = 0.0                                                         WINDY
   32 R22= 1.0 - R1                                                    WINDOP
      DO 33 I=1,3                                                      WINDY
      K= KK+I                                                          WINDY
   33 FT(I)=(R22*TAB(K) + R1*TAB(K-4))*CD                              WINDOP
      IF (NSR.EQ.0) GOTO 14                                            WINDOP
      CALL DOT31(D(1,1,NSR),FT,FF)                                     WINDOP
      DO 21 I=1,3                                                      WINDOP
21    FT(I)=FF(I)                                                      WINDOP
14    IF (MMM.LT.0) GOTO 15                                            WINDOP
C                                                                      WINDY
C     COMPUTE PRESENTED AREA TO WIND FORCE.                            WINDY
C                                                                      WINDY
      CALL MAT31 (D(1,1,M),FT,FF)                                      WINDY
      CALL MAT31 (BD(7,MM),FF,AF)                                      WINDY
      FAF = FF(1)*AF(1) + FF(2)*AF(2) + FF(3)*AF(3)                    WINDY
      IF (FAF.LE.0.0) GO TO 99                                         WINDY
      TF  = TM(1)*FF(1) + TM(2)*FF(2) + TM(3)*FF(3)                    WINDY
      BREF=0.0                                                         CCWIND
      TEMP=BTS-TF*TF/FAF                                               CCWIND
      IF(TEMP.GT.0.0) BREF =DSQRT(TEMP)                                CCWIND
      SCALE = (-BET+BREF)/(-BTE+BREF)                                  WINDY
      IF (SCALE.GE.1.0) GO TO 99                                       WINDY
      IF (SCALE.LT.0.0) SCALE = 0.0                                    WINDY
      TRACER = (BD( 7,MM)-AF(1)**2/FAF)*(BD(11,MM)-AF(2)**2/FAF)       WINDY
     *       + (BD( 7,MM)-AF(1)**2/FAF)*(BD(15,MM)-AF(3)**2/FAF)       WINDY
     *       + (BD(11,MM)-AF(2)**2/FAF)*(BD(15,MM)-AF(3)**2/FAF)       WINDY
     *       - (BD( 8,MM)-AF(1)*AF(2)/FAF)**2                          WINDY
     *       - (BD( 9,MM)-AF(1)*AF(3)/FAF)**2                          WINDY
     *       - (BD(12,MM)-AF(2)*AF(3)/FAF)**2                          WINDY
      AREA = (1.0-SCALE**2) * PI / DSQRT(TRACER)                       WINDY
C                                                                      WINDY
C     ADD FORCE AND TORQUES TO U1 AND U2 ARRAYS FOR SEGMENT M.         WINDY
C                                                                      WINDY
      SCALE = SCALE/BTE                                                WINDY
      DO 36 I=1,3                                                      WINDY
      RLM(I) = RM(I)*SCALE + BD(I+3,MM)                                WINDY
      FT (I) = FT(I)*AREA                                              WINDY
   36 FF (I) = FF(I)*AREA                                              WINDY
      CALL CROSS (RLM,FF,TQM)                                          WINDY
      DO 39 I=1,3                                                      WINDY
      WF(I,M)=FT(I)                                                    WINDOP
      U1(I,M) = U1(I,M) + FT(I)                                        WINDY
   39 U2(I,M) = U2(I,M) + TQM(I)                                       WINDY
      IF (NPRT(14).NE.0) WRITE (6,41) TIME,M,P,AREA,FT,TQM             WINDY
   41 FORMAT(' WIND FORCE',F14.6,I6,2F10.3,3X,3F12.5,3X,3F12.5)        WINDY
      GO TO 99                                                         WINDY
C                                                                      WINDY
```

```
C     USE GRID TO CALCULATE WIND FORCE                                  WINDOP
C            VP - ORIGIN OF WIND                                        WINDOP
C                                                                       WINDOP
15    AREAT=0.0                                                         WINDOP
      DO 16 I=1,3                                                       WINDOP
      TTF(I)=0.0                                                        WINDOP
      TQM(I)=0.0                                                        WINDOP
16    VP(I) = -FT(I)*10000.0                                            WINDOP
      TEMP=FT(1)**2+FT(2)**2+FT(3)**2                                   WINDOP
      IF (TEMP.EQ.0.0) GOTO 99                                          WINDOP
      CALL MAT31(D(1,1,M),FT,FF)                                        WINDOP
      TEMP = 0.0                                                        WINDOP
      IF (FT(1).NE.0.0.OR.FT(2).NE.0.0) GOTO 150                        WINDOP
C                                                                       WINDOP
C     CALCULATE DIRECTION COSINE MATRIX FOR VP COORD. SYS.              WINDOP
C                                                                       WINDOP
      DO 140 I=1,3                                                      WINDOP
      DO 140 J=1,3                                                      WINDOP
140   DVP(I,J)=0.0                                                      WINDOP
      DVP(1,2)=1.0                                                      WINDOP
      DVP(2,1)=1.0                                                      WINDOP
      DVP(3 3)=-1.0                                                     WINDOP
      GO TO 141                                                         WINDOP
150   CONTINUE                                                          WINDOP
      DO 110 I=1,3                                                      WINDOP
110   TEMP=TEMP+FT(I)*FT(I)                                             WINDOP
      TEMP = DSQRT(TEMP)                                                WINDOP
      XNORM = DSQRT(FT(1)*FT(1)/TEMP**2+FT(2)*FT(2)/TEMP**2)            WINDOP
      DVP(1,1) = FT(2)/(XNORM*TEMP)                                     WINDOP
      DVP(1,2) = -FT(1)/(XNORM*TEMP)                                    WINDOP
      DVP(1,3) = 0.0                                                    WINDOP
      DVP(2,1) = FT(1)*FT(3)/(XNORM*TEMP*TEMP)                          WINDOP
      DVP(2,2) = FT(2)*FT(3)/(XNORM*TEMP*TEMP)                          WINDOP
      DVP(2,3) = -XNORM                                                 WINDOP
      DO 130 I=1,3                                                      WINDOP
130   DVP(3,I) = FT(I)/TEMP                                             WINDOP
141   CONTINUE                                                          WINDOP
      MOELP = MWSEG(7,M)                                                WINDOP
C                                                                       WINDOP
C     PROJECT MM ELLIPSOID UNTO VP-PLANE                                WINDOP
C          AS - PROJECTED ELLIPSE MATRIX                                WINDOP
C                                                                       WINDOP
      CALL DOTT33(D(1,1,M),DVP,DD)                                      WINDOP
      CALL MAT33(BD(7,MM),DD,DDD)                                       WINDOP
      CALL DOT33(D(1,1,M),DDD,DD)                                       WINDOP
      CALL MAT33(DVP,DD,AM)                                             WINDOP
      DO 101 K=1,3                                                      WINDOP
101   SS(K)=SEGLP(K,M)+BD(K+3,MM)-VP(K)                                 WINDOP
      CALL MAT31(DVP,SS,SM)                                             WINDOP
      DO 114 K=1,3                                                      WINDOP
      IF (DABS(SM(K)).LT.EPS(5)) SM(K)=DSIGN(EPS(5),SM(K))              WINDOP
114   CONTINUE                                                          WINDOP
```

```
      CALL SOLVR(AM(1,1),AM(2,1),AM(3,1),AM(1,3),AM(2,3),AM(3,3),           WINDOP
     *           AM(1,1),AM(1,3),SM,R(1,1),R(3,1))                          WINDOP
      CALL SOLVR(AM(1,2),AM(2,2),AM(3,2),AM(1,3),AM(2,3),AM(3,3),           WINDOP
     *           AM(2,2),AM(2,3),SM,R(2,2),R(3,2))                          WINDOP
      CALL SOLVR(AM(1,1)+AM(1,2),AM(2,1)+AM(2,2),AM(3,1)+AM(3,2),           WINDOP
     *           AM(1,3),AM(2,3),AM(3,3),AM(1,1)+2.0*AM(1,2)+AM(2,2),       WINDOP
     *           AM(1,3)+AM(2,3),SM,R(1,3),R(3,3))                          WINDOP
      R(2,1)=0.0                                                            WINDOP
      R(1,2)=0.0                                                            WINDOP
      R(2,3)=R(1,3)                                                         WINDOP
      DO 102 K=1,3                                                          WINDOP
      DO 102 J=1,2                                                          WINDOP
102   R2(J,K)=R(J,K)                                                        WINDOP
      CALL SOLVA(R2,AS(1),AS(2),AS(3))                                      WINDOP
C                                                                           WINDOP
C     GET MAJOR & MINOR AXES OF PROJECTED ELLIPSE                           WINDOP
C                                                                           WINDOP
      TEMP=(AS(1)+AS(2))**2-4.0*(AS(1)*AS(2)-AS(3)**2)                      WINDOP
      IF (TEMP.LT.0.0) TEMP=0.0                                             WINDOP
      TEMP = DSQRT(TEMP)                                                    WINDOP
      AMDA1=(AS(1)+AS(2)+TEMP)/2.0                                          WINDOP
      AMDA2=(AS(1)+AS(2)-TEMP)/2.0                                          WINDOP
      R2(1,1)=AS(3)                                                         WINDOP
      R2(2,1)=AMDA1-AS(1)                                                   WINDOP
      R2(1,2)=AMDA2-AS(2)                                                   WINDOP
      R2(2,2)=AS(3)                                                         WINDOP
      AMDA1=DABS(AMDA1)                                                     WINDOP
      AMDA2=DABS(AMDA2)                                                     WINDOP
      B1=DSQRT(1.0/(AMDA1*(R2(1,1)**2+R2(1,2)**2)))                         WINDOP
      B2=DSQRT(1.0/(AMDA2*(R2(2,1)**2+R2(2,2)**2)))                         WINDOP
      R2(1,1)=R2(1,1)*B1                                                    WINDOP
      R2(1,2)=R2(1,2)*B2                                                    WINDOP
      R2(2,1)=R2(2,1)*B1                                                    WINDOP
      R2(2,2)=R2(2,2)*B2                                                    WINDOP
C                                                                           WINDOP
C     GET BLOCKING ELLIPSOIDS IN VP COORD. SYS.                             WINDOP
C                                                                           WINDOP
      DO 103 MI=1,MOELP                                                     WINDOP
      I=MOWSEG(M,MI*2-1)                                                    WINDOP
      II=MOWSEG(M,MI*2)                                                     WINDOP
      CALL DOTT33(D(1,1,I),DVP,DD)                                          WINDOP
      CALL MAT33(BD(7,II),DD,DDD)                                           WINDOP
      CALL DOT33(D(1,1,I),DDD,DD)                                           WINDOP
      CALL MAT33(DVP,DD,AI(1,1,MI))                                         WINDOP
      DO 104 K=1,3                                                          WINDOP
104   SS(K)=SEGLP(K,I)+BD(K+3,II)-VP(K)                                     WINDOP
      CALL MAT31(DVP,SS,SI(1,MI))                                           WINDOP
      DO 115 K=1,3                                                          WINDOP
      IF (DABS(SI(K,MI)).LT.EPS(6)) SI(K,MI)=DSIGN(EPS(6),SI(K,MI))         WINDOP
115   CONTINUE                                                              WINDOP
103   CONTINUE                                                              WINDOP
C                                                                           WINDOP
```

```
C     SET-UP GRID AND CHECK EACH RECTANGLE CENTER POINT                WINDOP
C                                                                      WINDOP
      AREA=DSQRT((R2(1,1)**2+R2(2,1)**2)*(R2(1,2)**2+R2(2,2)**2))      WINDOP
      AREA=AREA/NSTEPS**2                                              WINDOP
      IN=2*NSTEPS+1                                                    WINDOP
      DO 105 I=1,IN                                                    WINDOP
      RXC=R2(1,1)-R2(1,1)*(I-1)/NSTEPS                                 WINDOP
      RYC=R2(2,1)-R2(2,1)*(I-1)/NSTEPS                                 WINDOP
      DO 106 J=1,IN                                                    WINDOP
      RM(1)=(RXC-R2(1,2)*(NSTEPS-J+1)/NSTEPS)*0.9999                   WINDOP
      RM(2)=(RYC-R2(2,2)*(NSTEPS-J+1)/NSTEPS)*0.9999                   WINDOP
      TM(1)=AM(3,3)                                                    WINDOP
      TM(2)=2.0*(RM(1)*AM(1,3)+RM(2)*AM(2,3))                          WINDOP
      TM(3)=RM(1)**2*AM(1,1)+RM(2)**2*AM(2,2)+2.0*RM(1)*RM(2)*AM(1,2)-1.WINDOP
      TEMP=TM(2)**2-4.0*TM(1)*TM(3)                                    WINDOP
      IF (TEMP.LT.0.0) GOTO 106                                        WINDOP
      B1=(DSQRT(TEMP)-TM(2))/(2.0*TM(1))                               WINDOP
      B2=-(DSQRT(TEMP)+TM(2))/(2.0*TM(1))                              WINDOP
      RM(3)=B1                                                         WINDOP
      IF (B2.LT.B1) RM(3)=B2                                           WINDOP
      SN1(1)=RM(1)+SM(1)                                               WINDOP
      SN1(2)=RM(2)+SM(2)                                               WINDOP
      SN1(3)=RM(3)+SM(3)                                               WINDOP
      CALL DOT31(DVP,SN1,XMM)                                          WINDOP
C                                                                      WINDOP
C     CHECK FOR PENETRATION                                            WINDOP
C                                                                      WINDOP
      DO 107 K=1,3                                                     WINDOP
107   XMN(K)=VP(K)-SEGLP(K,N)+XMM(K)                                   WINDOP
      CALL MAT31(D(1,1,N),XMN,XMM)                                     WINDOP
      BET=PL(4,NN)                                                     WINDOP
      BTS=PL(1,NN)*XMM(1)+PL(2,NN)*XMM(2)+PL(3,NN)*XMM(3)              WINDOP
      IF (BTS.GT.BET) GOTO 106                                         WINDOP
C                                                                      WINDOP
C     CHECK FOR BLOCKING ELLIPSOIDS                                    WINDOP
C                                                                      WINDOP
      DO 109 IM=1,MOELP                                                WINDOP
      X=SN1(1)-SI(1,IM)                                                WINDOP
      Y=SN1(2)-SI(2,IM)                                                WINDOP
      TM(1)=AI(3,3,IM)                                                 WINDOP
      TM(2)=2.0*(AI(1,3,IM)*X+AI(2,3,IM)*Y)                            WINDOP
      TM(3)=AI(1,1,IM)*X**2+AI(2,2,IM)*Y**2+2.0*AI(1,2,IM)*X*Y-1.0     WINDOP
      TEMP=TM(2)**2-4.0*TM(1)*TM(3)                                    WINDOP
      IF (TEMP.LT.0.0) GOTO 109                                        WINDOP
      B1=(-TM(2)+DSQRT(TEMP))/(2.0*TM(1))                              WINDOP
      B2=(-TM(2)-DSQRT(TEMP))/(2.0*TM(1))                              WINDOP
      IF (B2.LT.B1) B1=B2                                              WINDOP
      SNZ=B1+SI(3,IM)                                                  WINDOP
      IF (SNZ.LT.SN1(3)) GOTO 106                                      WINDOP
109   CONTINUE                                                         WINDOP
      CALL DOT31(DVP,RM,SS)                                            WINDOP
      CALL MAT31(D(1,1,M),SS,RM)                                       WINDOP
```

```
C                                                                    WINDOP
C     SUM FORCES & TORQUES                                           WINDOP
C                                                                    WINDOP
      AREAT=AREAT+AREA                                               WINDOP
      DO 111 K=1,3                                                   WINDOP
      TTF(K)=FT(K)*AREA+TTF(K)                                       WINDOP
      RM(K)=RM(K)+BD(K+3,MM)                                         WINDOP
111   FFT(K)=FF(K)*AREA                                              WINDOP
      CALL CROSS(RM,FFT,TM)                                          WINDOP
      DO 112 K=1,3                                                   WINDOP
112   TQM(K)=TQM(K)+TM(K)                                            WINDOP
106   CONTINUE                                                       WINDOP
105   CONTINUE                                                       WINDOP
C                                                                    WINDOP
C     ADD FORCE & TORQUE TO U1 & U2 ARRAYS FOR SEGMENT M             WINDOP
C                                                                    WINDOP
      IF (NPRT(14).NE.0) WRITE(6,200) TIME,M,AREAT,TTF,TQM           WINDOP
200   FORMAT(' WIND FORCE',F14.6,I6,13X,F10.3,3F12.5,3X,3F12.5)      WINDOP
      DO 113 I=1,3                                                   WINDOP
      WF(I,M)=TTF(I)                                                 WINDOP
      U1(I,M)=U1(I,M)+TTF(I)                                         WINDOP
113   U2(I,M)=U2(I,M)+TQM(I)                                         WINDOP
      GO TO 99                                                       WINDOP
C                                                                    WINDOP
C     M = 0: CALCULATE FORCE FUNCTIONS.                              WINDOP
C                                                                    WINDY
   50 NFORCE = NFVSEG(6)                                             WINDY
      DO 60 J=1,NFORCE                                               WINDY
      NFS = IABS(NFVSEG(J))                                          WINDY
      NFT = IABS(NFVNT(J))                                           WINDY
      KFT = NTI(NFT)                                                 WINDY
      FRCE = EVALFD(TIME,KFT,1)                                      WINDY
      IF  (NFVSEG(J).GT.0)  GO TO 52                                 WINDY
      DO  51  I=1,3                                                  WINDY
   51 U2(I,NFS) = U2(I,NFS) + FRCE*QFU(I,J)                          WINDY
      GO TO 60                                                       WINDY
   52 CALL DOT31 (D(1,1,NFS),QFU(1,J),TM)                            WINDY
      DO  53  I=1,3                                                  WINDY
      U1(I,NFS) = U1(I,NFS) + FRCE*TM(I)                             WINDY
   53 U2(I,NFS) = U2(I,NFS) + FRCE*QFV(I,J)                          WINDY
   60 CONTINUE                                                       WINDY
   99 CALL ELTIME (2,37)                                             WINDY
      RETURN                                                         WINDY
      END                                                            WINDY
```

```
      DOUBLE PRECISION FUNCTION XDY(X,D,Y)                              XDY
C                                                 REV IV    07/23/86JTF786
C     FUNCTION ROUTINE TO COMPUTE X.DY OR Y.D'X                         XDY
C                                                                       XDY
      IMPLICIT REAL*8(A-H,O-Z)                                          XDY
      DIMENSION X(3),D(3,3),Y(3)                                        XDY
      XDY = 0.0                                                         XDY
      DO 10 I=1,3                                                       XDY
   10 XDY = XDY + X(I)*(D(I,1)*Y(1)+D(I,2)*Y(2)+D(I,3)*Y(3))           JTF786
      RETURN                                                            XDY
      END                                                               XDY
```

```
      SUBROUTINE YPRDEG(D,A)                                            YPRDEG
C                                                  REV IV    11/26/86YPRFIX
C     COMPUTES YAW PITCH AND ROLL IN DEGREES AND PLACES THEM            YPRDEG
C        INTO THE A ARRAY FOR A GIVEN DIRECTION COSINE MATRIX D.        YPRDEG
C                                                                       YPRDEG
C        ASSUMES D - D(R)D(P)D(Y) , WHERE                               YPRDEG
C                                                                       YPRDEG
C            1  0  0           CP 0 -SP             CY SY 0             YPRDEG
C     D(R) - 0  CR SR  ,D(P) - 0  1  0  AND D(Y) - -SY CY 0             YPRDEG
C            0 -SR CR          SP 0  CP             0  0  1             YPRDEG
C                                                                       YPRDEG
      IMPLICIT REAL*8(A-H,O-Z)                                          YPRDEG
      DIMENSION A(3),D(3,3)                                             YPRDEG
      COMMON/CNSNTS/ PI,RADIAN,G,THIRD,EPS(24),                         YPRDEG
     *               UNITL,UNITM,UNITT,GRAVTY(3),TWOPI                  TWOPI
      IF (DABS(D(1,1)).LE.EPS(15).AND.DABS(D(1,2)).LE.EPS(15))GOTO10    YPRFIX
      IF (DABS(D(2,3)).LE.EPS(15).AND.DABS(D(3,3)).LE.EPS(15))GOTO10    YPRFIX
      YAW - DATAN2(D(1,2),D(1,1))                                       YPRDEG
      ROLL - DATAN2(D(2,3),D(3,3))                                      YPRDEG
      GO TO 11                                                          YPRDEG
   10 YAW - DATAN2(-D(2,1),D(2,2))                                      YPRDEG
      ROLL - 0.0                                                        YPRDEG
   11 PITCH - -DASIN(D(1,3))                                            YPRDEG
      IF (DABS(ROLL).LE.0.5*PI) GO TO 20                                YPRDEG
      IF (DABS(YAW ).LE.0.5*PI) GO TO 20                                YPRDEG
      PITCH - DSIGN(PI-DABS(PITCH),PITCH)                               YPRDEG
      YAW  - DATAN2(-D(1,2),-D(1,1))                                    YPRDEG
      ROLL - DATAN2(-D(2,3),-D(3,3))                                    YPRDEG
   20 A(1) - YAW/RADIAN                                                 YPRDEG
      A(2) - PITCH/RADIAN                                               YPRDEG
      A(3) - ROLL/RADIAN                                                YPRDEG
      RETURN                                                            YPRDEG
      END                                                               YPRDEG
```

APPENDIX J

386-VIEW Program Listing

```
      PROGRAM VIEW                                                      V1.1
      COMMON/PLTT/SFACTR,INT,TIME,ICOLOR(91),OFSETX,OFSETY,ZTIME        V1.1
      COMMON/INTERS/ NIE(90),IE(90,90)                                  V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),       V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                        V1.2
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),P0(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
      COMMON/ATB/PL(17,30)                                              V1.1
      COMMON/VIEWP/VPO(3),DVPO(3,3),IVP,VP2(3)                          V1.1
      COMMON/DBUG/IDEBUG(80),NISG,DEVFLG,ONLINE,TERM,BDRS,OFLINE        V1.1
      COMMON/DEVICE/IDEF,IOPORT,MODEL                                  80386
      DIMENSION WORK(10000)                                             V1.1
      CHARACTER*4 ID(10)                                               80386
      INTEGER DEVFLG,ONLINE,TERM,BDRS,OFLINE                            V1.1
      DOUBLE PRECISION ZTIME,CTIME,STIME,DTIME,ETIME                    V1.1
      CHARACTER*12 FILE1,FILE5,FILE6                                   80386
C                                                                       V1.1
C    PROGRAM VIEW           VERSION 1.1     LAST MOD. - MARCH 9, 1983   V1.1
C                           VERSION 1.2     LAST MOD. - DECEMBER 18, 1984  V1.2
C    WRITTEN BY SRL IN SUPPORT OF THE                                   V1.1
C    MODELING AND ANALYSIS BRANCH OF AMRL                               V1.1
C    AT WPAFB.                                                          V1.1
C                                                                      80386
C        80386 IMPLEMENTATION BY KETRON, INC.     - OCTOBER 31, 1989   80386
C                                                                       V1.1
C    STORED ON TAPE1 THAT IS OUTPUT FROM THE ATBM VERSION V5D.          V1.1
C                                                                       V1.1
C    THIS PROGRAM USES CONTOUR LINES TO REPRESENT THE 3-D PROPERTIES OF V1.1
C    THE DATA ON TAPE1. THE CONTOUR LINES ARE PLOTTED ON PAPER THAT     V1.1
C    REPRESENTS THE PROJECTION PLANE. THE POINTS THAT COMPOSE A CONTOUR V1.1
C    LINE IN 3-SPACE ARE PROJECTED THROUGH A POINT ON TO THE PROJECTION V1.1
C    PLANE.                                                             V1.1
C                                                                       V1.1
C    CURRENTLY THERE ARE TWO CLASSES OF OBJECTS THAT ARE PLOTTED USING  V1.1
C    CONTOUR LINES.                                                     V1.1
C       CLASS 1 - ELLIPSOIDS                                            V1.1
C    ELLIPSOIDS ARE USED TO REPRESENT BODY SEGMENTS. THIS PROGRAM ALLOWS V1.1
C    ELLIPSOIDS TO BE IMBEDDED IN OTHER ELLIPSOIDS.                     V1.1
C                                                                       V1.1
C       CLASS 2 - CONVEX POLYGONS                                       V1.1
C    CONVEX POLYGONS ARE USED TO REPRESENT OBJECTS THAT CAN BE DEFINED  V1.1
C    BY A SET OF PLANES. ALL POLYGONS DEFINED BY THE INPUT MUST BE      V1.1
C    CONVEX POLYGONS; CONCAVE POLYGONS CAN BE OBTAINED USING A          V1.1
C    COMBINATION OF CONVEX POLYGONS.                                    V1.1
C                                                                       V1.1
C    THE HIDDEN LINE ROUTINES CHECK FOR POINTS HIDDEN BY                V1.1
C    ELLIPSOIDS OR POLYGONS. THESE ROUTINES MUST CHECK                  V1.1
C    FOR ANY POSSIBLE OBJECT THAT MAY BE BLOCKING THE                   V1.1
C    CURRENT POINT AS SEEN FROM THE VIEWPOINT.                          V1.1
C    IN ORDER TO ELIMINATE CHECKING ALL OBJECTS FOR                     V1.1
C    EACH POINT, SUBROUTINES ARE INCLUDED IN THE                        V1.1
C    VIEW PROGRAM THAT DETECT OBJECT OVERLAP ON THE                     V1.1
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C    PROJECTION PLANE. BEFORE THE PLOTTING PHASE OF THE                V1.1
C    VIEW PROGRAM, OBJECTS WHICH OVERLAP EACH OTHER ON                 V1.1
C    THE PROJECTION PLANE ARE RECORDED IN THE IE ARRAY.                V1.1
C    DURING THE PLOTTING PHASE OF THE VIEW PROGRAM, THE                V1.1
C    IE ARRAY IS REORDERED TO DECREASE THE SEARCH TIME                 V1.1
C    FOR OBJECTS THAT MAY BE BLOCKING THE CURRENT POINT                V1.1
C    BEING PLOTTED. THE ASSUMPTION USED HERE IS - IF AN                V1.1
C    OBJECT BLOCKED THE PREVIOUS POINT ON A CONTOUR LINE               V1.1
C    THEN THAT OBJECT PROBABLY BLOCKS THE NEXT POINT                   V1.1
C    ON THE CONTOUR LINE.                                              V1.1
C                                                                      V1.1
      OPEN (UNIT=4,FILE='VIEWPE.DIR',STATUS='OLD')                    80386
      READ (4,'(A12/A12/A12)')FILE1,FILE5,FILE6                       80386
      READ (4,'(I4/I4/I4)')IDEF,IOPORT,MODEL                          80386
      OPEN (UNIT=1,FILE=FILE1,STATUS='OLD',FORM='UNFORMATTED')        80386
      OPEN (UNIT=5,FILE=FILE5,STATUS='OLD')                           80386
      OPEN (UNIT=6,FILE=FILE6,STATUS='NEW',CARRIAGE CONTROL='FORTRAN') 80386
C     LUPLOT=8                                                        80386
      ONLINE=1                                                         V1.1
      TERM=2                                                           V1.1
      NF=0                                                             V1.1
      OFLINE=3                                                         V1.1
      BDRS=4                                                           V1.1
      READ(5,130) DEVFLG                                               V1.1
      DEVFLG=BDRS                                                     80386
      WRITE(6,130) DEVFLG                                              V1.1
130   FORMAT(I1)                                                       V1.1
C                                                                      V1.1
      CALL PLOTS(IDEF,IOPORT,MODEL)                                   80386
      CALL FACTOR(.75)                                                80386
C                                                                      V1.1
      IFLAG = 0                                                        V1.1
      CALL TITLE                                                       V1.1
      CALL FACTOR(1.0)                                                80386
      READ(5,200) (ID(I),I=1,10)                                       V1.1
      WRITE(6,200) (ID(I),I=1,10)                                      V1.1
  200 FORMAT(10A4)                                                     V1.1
      READ(5,150) STIME,DTIME,ETIME                                    V1.1
150   FORMAT(3D10.0)                                                   V1.1
      CTIME=STIME-DTIME                                                V1.1
      ITIME=CTIME*1000000.D0                                           V1.1
      CTIME=ITIME/1000000.D0                                           V1.1
      READ(5,125) IDEBUG                                               V1.1
      WRITE(6,125) IDEBUG                                              V1.1
 125  FORMAT(80I1)                                                     V1.1
  100 CONTINUE                                                         V1.1
      IFLAG = IFLAG + 1                                                V1.1
      CTIME=CTIME+DTIME                                                V1.1
      ITIME=CTIME*1000000.D0                                           V1.1
      CTIME=ITIME/1000000.D0                                           V1.1
      IF(CTIME.GT.ETIME) CALL PLOT(0.,0.,999)                          V1.1
      IF(CTIME.GT.ETIME) STOP                                          V1.1
```

```
      CALL INPUT(CTIME)                                                V1.1
      IF(IFLAG.EQ.10) GO TO 100                                        V1.1
      IF(DEVFLG.EQ.OFLINE.OR.DEVFLG.EQ.BDRS)                          80386
     *   CALL COLOR(ICOLOR(91),IERR)                                  80386
      XTIME=ZTIME*1000.0                                               V1.1
      NF=NF+1                                                          V1.1
      WRITE(6,1000)NF                                                  V1.1
 1000 FORMAT(' MAIN - PROCESSING FRAME #',I4)                          V1.1
      CALL PLOT(0.,0.,-3)                                              V1.1
      CALL SYMBOL(.5, 8.0,.335,ID,0.,35)                              80386
      CALL SYMBOL(.5,7.0,.335,'TIME(MSEC)',0.,10)                     80386
      CALL NUMBER(3.85,7.0,.335,XTIME,0.,-1)                          80386
      CALL MAT(DVP0,D(1,1,IVP),DVP,3,3,3,3,3,3)                        V1.1
      CALL DOT(D(1,1,IVP),VP0,VP,3,1,3)                                V1.1
      DO 10 K=1,3                                                      V1.1
   10 VP(K)=VP(K)+SEGLP(K,IVP)                                         V1.1
      CALL MAT(DVP,VP,VP2,3,3,1,3,3,3)                                 V1.1
      CALL CONVREC                                                     V1.1
      CALL PRJPLY                                                      V1.1
      CALL PRJELR                                                      V1.1
      CALL POLYD                                                       V1.1
      CALL BUILDIE                                                     V1.1
      IF(IDEBUG(1).EQ.1) WRITE(6,350) (NIE(I),I=1,90)                  V1.1
      IF(IDEBUG(2).EQ.1) WRITE(6,350) ((IE(I,J),I=1,90),J=1,90)        V1.1
  350 FORMAT(270(30(1X,I2)/))                                          V1.1
      DO 30 IK=1,NSEG                                                  V1.1
      IF(DEVFLG.EQ.OFLINE.OR.DEVFLG.EQ.BDRS) CALL COLOR(ICOLOR(IK),IERR)80386
      IELP=IK                                                          V1.1
      INDEX=NSTEPS(IK)+1                                               V1.1
      INDEX2=4*INDEX-3                                                 V1.1
      IX1=1                                                            V1.1
      IIN=3*INDEX*INDEX+IX1                                            V1.1
      ISEG=IIN+INDEX                                                   V1.1
      CALL ELIPSN(INDEX,WORK(IX1),WORK(IIN))                           V1.1
      CALL PSE(WORK(IX1),WORK(IIN),WORK(ISEG),INDEX,INDEX2,1)          V1.1
      CALL PSE(WORK(IX1),WORK(IIN),WORK(ISEG),INDEX,INDEX2,2)          V1.1
   30 CONTINUE                                                         V1.1
      CALL PLPLN(WORK,INDEX2)                                          V1.1
      IF(DEVFLG.EQ.BDRS) CALL NFRAME                                   V1.1
      IF(DEVFLG.EQ.OFLINE.OR.DEVFLG.EQ.ONLINE) CALL PLOT (12.,0.0,-3)  V1.1
      IF(DEVFLG.EQ.TERM) CALL PLOT(0.,0.,-3)                           V1.1
      GO TO 100                                                        V1.1
      END                                                              V1.1
```

```
      SUBROUTINE BUILDIE                                                V1.1
C                                                                       V1.1
C     ONCE THIS SUBROUTINE IS CALLED ALL OBJECTS ARE REPRESENTED BY     V1.1
C     POLYGONS PROJECTED ON THE VIEWPOINT PROJECTION PLANE.             V1.1
C     THIS SUBROUTINE WILL BUILD THE IE AND NIE ARRAYS.                 V1.1
C     NEE(K) REPRESENTS THE NEMBER OF ENTRIES IN THE IE(I,K) ARRAY FOR  V1.1
C     OBJECT K.                                                         V1.1
C     THE IE(I,K) ARRAY CONTAINS OBJECT NUMBERS FOR OBJECTS THAT OVERLAP V1.1
C     IN THE PROJECTION PLANE.                                          V1.1
C     FOR EXAMPLE, IE(1,2) MIGHT CONTAIN A 3 WHICH MEANS OBJECT 3       V1.1
C     OVERLAPS WITH OBJECT 2.                                           V1.1
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),PO(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),       V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                        V1.2
      COMMON/INTERS/ NIE(90),IE(90,90)                                  V1.1
      COMMON/REMOVE/NPREM,IREMOV(30)                                    V1.1
      DO 5 I=1,90                                                       V1.1
      NIE(I) = 0                                                        V1.1
      DO 5 K=1,90                                                       V1.1
    5 IE(I,K) = 0                                                       V1.1
      IF(NSEG .EQ. 0) GO TO 60                                          V1.1
      DO 55 I=1,NSEG                                                    V1.1
      IF(NIE(I) .NE. 0)  GO TO 10                                       V1.1
      NIE(I) = 1                                                        V1.1
      IE(1,I) = I                                                       V1.1
   10 IOBJ = I + 1                                                      V1.1
      IF(I.EQ.NSEG) GO TO 31                                            V1.1
      DO 30  K=IOBJ,NSEG                                                V1.1
      CALL OVERLAP(I,K,MFLAG)                                           V1.1
      IF(MFLAG .EQ. 0)  GO TO 30                                        V1.1
C                                                                       V1.1
C     YES, THERE IS OVERLAP BETWEEN I AND K                             V1.1
C                                                                       V1.1
      IF(NIE(K) .NE. 0)  GO TO 20                                       V1.1
      NIE(K) = 1                                                        V1.1
      IE(1,K) = K                                                       V1.1
   20 NIE(K) = NIE(K) + 1                                               V1.1
      NIE(I) = NIE(I) + 1                                               V1.1
      IE(NIE(I),I) = K                                                  V1.1
      IE(NIE(K),K) = I                                                  V1.1
   30 CONTINUE                                                          V1.1
   31 CONTINUE                                                          V1.1
      IF(NPLANE.EQ.0) GO TO 55                                          V1.1
      IOBJ = NPLANE + 30                                                V1.1
      DO 50  K=31,IOBJ                                                  V1.1
      DO 200 LT=1,NPREM                                                 V1.1
      IF(K-30.EQ.IREMOV(LT)) GO TO 50                                   V1.1
200   CONTINUE                                                          V1.1
      CALL OVERLAP(I,K,MFLAG)                                           V1.1
      IF(MFLAG .EQ. 0)  GO TO 50                                        V1.1
C                                                                       V1.1
```

```
C     YES, THERE IS OVERLAP BETWEEN I AND K                                  V1.1
C                                                                            V1.1
      NIE(K) = NIE(K) + 1                                                    V1.1
      NIE(I) = NIE(I) + 1                                                    V1.1
      IE(NIE(I),I) = K                                                       V1.1
      IE(NIE(K),K) = I                                                       V1.1
   50 CONTINUE                                                               V1.1
   55 CONTINUE                                                               V1.1
C                                                                            V1.1
C     NOW CHECK PLANE AGAINST PLANE                                          V1.1
C                                                                            V1.1
   60 IF(NPLANE .LE. 1)  RETURN                                              V1.1
      MPLANE=NPLANE+29                                                       V1.1
      KPLANE=NPLANE+30                                                       V1.1
      DO 100 I=31,MPLANE                                                     V1.1
      DO 300 LT=1,NPREM                                                      V1.1
      IF(I-30.EQ.IREMOV(LT)) GO TO 100                                       V1.2
300   CONTINUE                                                               V1.1
      IOBJ = I + 1                                                           V1.1
      DO 400 K=IOBJ,KPLANE                                                   V1.1
      CALL OVERLAP(I,K,MFLAG)                                                V1.1
      IF(MFLAG .EQ. 0)  GO TO 400                                            V1.1
C                                                                            V1.1
C     YES, THERE IS OVERLAP BETWEEN I AND K                                  V1.1
C                                                                            V1.1
      DO 500 LT=1,NPREM                                                      V1.2
      IF(K-30.EQ.IREMOV(LT)) GO TO 400                                       V1.2
500   CONTINUE                                                               V1.2
      NIE(K) = NIE(K) + 1                                                    V1.1
      NIE(I) = NIE(I) + 1                                                    V1.1
      IE(NIE(I),I) = K                                                       V1.1
      IE(NIE(K),K) = I                                                       V1.1
  400 CONTINUE                                                               V1.1
  100 CONTINUE                                                               V1.1
      RETURN                                                                 V1.1
      END                                                                    V1.1
```

```
      SUBROUTINE CLIP(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,IPEN,IPLOT)         V1.1
C   ********************************************                            V1.1
C                                                                           V1.1
C  THIS SUBROUTINE CLIPS PLOTTING OFF BOTH ENDS OF THE CALCOMP DRUM        V1.1
C                                                                           V1.1
C   ********************************************                            V1.1
C                                                                           V1.1
      LOGICAL XOFF,YOFF                                                     V1.1
      DATA LCALL/0/                                                         V1.1
C                                                                           V1.1
C  DETERMINE IF X AND/OR Y CLIPPING AND IF OFF TOP,BOTTOM,LEFT,            V1.1
C  OR RIGHT OF PLOTTER                                                      V1.1
C                                                                           V1.1
      XOFF=.FALSE.                                                          V1.1
      YOFF=.FALSE.                                                          V1.1
      IF (X.LT.XMIN.OR.X.GT.XMAX) XOFF=.TRUE.                               V1.1
      IF (Y.LT.YMIN.OR.Y.GT.YMAX) YOFF=.TRUE.                               V1.1
      IF (X.LT.XMIN) XLIMIT=XMIN                                            V1.1
      IF (X.GT.XMAX) XLIMIT=XMAX                                            V1.1
      IF (Y.LT.YMIN) YLIMIT=YMIN                                            V1.1
      IF (Y.GT.YMAX) YLIMIT=YMAX                                            V1.1
C                                                                           V1.1
C  IF PREVIOUS CALL TO CLIP WAS A PEN UP TO 1ST POINT IN SEGMENT,          V1.1
C  INTERPOLATE USING NEW AND SAVED COORD.'S, MOVE PEN, RESET SAVE          V1.1
C  VALUES FOR X+Y POINTS, AND CONTINUE                                      V1.1
C                                                                           V1.1
      IF (LCALL.EQ.0) GO TO 10                                              V1.1
           IF (XOFF) YLTEMP=YINTCP(X,Y,XSAV,YSAV,XLIMIT)                    V1.1
           IF (.NOT.XOFF) YLTEMP=YLIMIT                                     V1.1
           IF (YOFF) XLTEMP=XINTCP(X,Y,XSAV,YSAV,YLIMIT)                    V1.1
           IF (.NOT.YOFF) XLTEMP=XLIMIT                                     V1.1
           IF (XLTEMP.LT.XMIN) XLTEMP=XMIN                                  V1.1
           IF (XLTEMP.GT.XMAX) XLTEMP=XMAX                                  V1.1
           IF (YLTEMP.LT.YMIN) YLTEMP=YMIN                                  V1.1
           IF (YLTEMP.GT.YMAX) YLTEMP=YMAX                                  V1.1
           CALL PLOT(XLTEMP,YLTEMP,3)                                       V1.1
           XSAV=XLTEMP                                                      V1.1
           YSAV=YLTEMP                                                      V1.1
           LCALL=0                                                          V1.1
C                                                                           V1.1
C  IF 1ST POINT OF SEGMENT AND PEN UP, SAVE THESE COORD.'S, SET            V1.1
C  FLAG, AND EXIT                                                           V1.1
C                                                                           V1.1
10    CONTINUE                                                              V1.1
      IF (IPLOT.NE.1.OR.IPEN.NE.3) GO TO 20                                 V1.1
           XLSAV=X                                                          V1.1
           YLSAV=Y                                                          V1.1
           LCALL=1                                                          V1.1
           IPLOT=0                                                          V1.1
           RETURN                                                           V1.1
C                                                                           V1.1
C  DO WE WANT TO PLOT?                                                      V1.1
```

```
C                                                                        V1.1
20    CONTINUE                                                           V1.1
      IF (IPLOT.NE.1) GO TO 30                                           V1.1
C                                                                        V1.1
C  DETERMINE X AND Y COORDINATES TO PLOT TO                              V1.1
C                                                                        V1.1
      IF (XOFF) YTEMP-YINTCP(X,Y,XSAV,YSAV,XLIMIT)                       V1.1
      IF (.NOT.XOFF) YTEMP-YLIMIT                                        V1.1
      IF (YOFF) XTEMP-XINTCP(X,Y,XSAV,YSAV,YLIMIT)                       V1.1
      IF (.NOT.YOFF) XTEMP-XLIMIT                                        V1.1
C                                                                        V1.1
C  PLOT ONLY THE FIRST SEGMENT AFTER CLIPPING DETERMINED, IGNORING       V1.1
C  ALL SEGMENTS AFTER UNLESS PEN TO BE LIFTED.                           V1.1
C                                                                        V1.1
      CALL PLOT(XTEMP,YTEMP,IPEN)                                        V1.1
30    CONTINUE                                                           V1.1
      IPLOT-0                                                            V1.1
      RETURN                                                             V1.1
      END                                                                V1.1
```

```
      SUBROUTINE CONVREC                                                  V1.1
C                                                                         V1.1
C       THIS SUBROUTINE CONVERTS RECTANGLES IN THE ATB                    V1.1
C     SIMULATION FORMAT TO POLYGONS IN THE VIEW PLOTTING FORMAT.          V1.1
C                                                                         V1.1
      COMMON/ATB/PL(17,30)                                                V1.1
      DIMENSION R(3)                                                      V1.1
      DIMENSION DX(3)                                                     V1.1
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),PO(3,4,60),P(3,4,60),          V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                   V1.1
      COMMON/CONECT/ NP,MPL(3,5,60)                                       V1.1
      COMMON/DBUG/IDEBUG(80),NISG,DEVFLG,ONLINE,TERM,BDRS,OFLINE          V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),         V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                          V1.2
      INTEGER DEVFLG,ONLINE,TERM,BDRS,OFLINE                              V1.1
      IF(NPLANE.EQ.0) RETURN                                              V1.1
      IF(IDEBUG(4).NE.0) WRITE(6,50)                                      V1.1
   50 FORMAT(1H1,'PLANE INFORMATION',/,1H ,17(1H*))                       V1.1
      DO 100 J-1,NPLANE                                                   V1.1
      IF(J.GT.NP) GO TO 15                                                V1.1
      IF(IFLAG.NE.1) GO TO 15                                             V1.1
      DDD-DET(PL(1,J),PL(2,J),PL(3,J),PL(8,J),PL(9,J),PL(10,J),           V1.1
     -        PL(13,J),PL(14,J),PL(15,J))                                 V1.1
      DX(1) - DET(PL(4,J),PL(2,J),PL(3,J),PL(11,J),PL(9,J),PL(10,J),      V1.1
     -            PL(16,J),PL(14,J),PL(15,J))                             V1.1
      DX(2) - DET(PL(1,J),PL(4,J),PL(3,J),PL(8,J),PL(11,J),PL(10,J),      V1.1
     -            PL(13,J),PL(16,J),PL(15,J))                             V1.1
      DX(3) - DET(PL(1,J),PL(2,J),PL(4,J),PL(8,J),PL(9,J),PL(11,J),       V1.1
     -            PL(13,J),PL(14,J),PL(16,J))                             V1.1
      DO 10  I-1,3                                                        V1.1
      TEMP-DX(I)/DDD                                                      V1.1
      PO(I,1,J)-TEMP                                                      V1.1
      PO(I,2,J)-PL(I+7,J)*PL(12,J)+TEMP                                   V1.1
      PO(I,3,J)-PL(I+12,J)*PL(17,J)+PO(I,2,J)                             V1.1
   10 PO(I,4,J)-PL(I+12,J)*PL(17,J)+TEMP                                  V1.1
   15 CONTINUE                                                            V1.1
      ISG-MPL(1,1,J)                                                      V1.1
      IF(ISG.EQ.0) ISG-NISG                                               V1.1
      IF(IDEBUG(4).NE.0) WRITE(6,200) ISG                                 V1.1
  200 FORMAT(1X,'ISG-',I2)                                                V1.1
      DO 20 L-1,4                                                         V1.1
      CALL DOT(D(1,1,ISG),PO(1,L,J),R,3,1,3)                              V1.1
      DO 20 I-1,3                                                         V1.1
      P(I,L,J)-R(I)+SEGLP(I,ISG)                                          V1.1
   20 CONTINUE                                                            V1.1
      IF(J.LE.NP) NPPP(J+30)-4                                            V1.1
      IF(IDEBUG(4).NE.0) WRITE(6,3000)                                    V1.1
 3000 FORMAT(1X,30(1H*))                                                  V1.1
      IF(IDEBUG(4).NE.0) WRITE(6,2000) J                                  V1.1
 2000 FORMAT(3X,'PLANE NUMBER - ',I3)                                     V1.1
      JJ-J                                                                V1.1
      NPPPP-NPPP(J+30)                                                    V1.1
```

```
      IF(IDEBUG(4).NE.0) WRITE(6,1000)((P(I,K,JJ),I=1,3),K=1,NPPPP)            V1.1
 1000 FORMAT(3X,F7.2,3X,F7.2,3X,F7.2)                                          V1.1
  100 CONTINUE                                                                 V1.1
      RETURN                                                                   V1.1
      END                                                                      V1.1
```

```
      SUBROUTINE CROSS(A,B,C)                                         V1.1
C     COMPUTES VECTOR CROSS PRODUCT C=AXB                             V1.1
      DIMENSION A(3),B(3),C(3)                                        V1.1
      C(1)=A(2)*B(3)-A(3)*B(2)                                        V1.1
      C(2)=A(3)*B(1)-A(1)*B(3)                                        V1.1
      C(3)=A(1)*B(2)-A(2)*B(1)                                        V1.1
      RETURN                                                          V1.1
      END                                                             V1.1
```

```
      FUNCTION DET(A11,A12,A13,A21,A22,A23,A31,A32,A33)                V1.1
      DET=A11*(A22*A33-A23*A32)-A12*(A21*A33-A23*A31)                  V1.1
     1+A13*(A21*A32-A22*A31)                                           V1.1
      RETURN                                                           V1.1
      END                                                              V1.1
```

```
      SUBROUTINE DOT(A,B,C,N,M,L)                                       V1.1
C                                                  REV 03 05/31/73      V1.1
C     PERFORMS MATRIX MULTIPLICATION C = A'B.                           V1.1
C     IF A AND B ARE VECTORS, C IS THE DOT PRODUCT A.B                  V1.1
C                                                                       V1.1
C       ARGUMENTS:                                                      V1.1
C         A: MATRIX OF SIZE (L,N).                                      V1.1
C         B: MATRIX OF SIZE (L,M).                                      V1.1
C         C: PRODUCT MATRIX OF SIZE (N,M).                              V1.1
C         N,M,L: SIZES OF MATRICES A,B,C.                               V1.1
C                                                                       V1.1
C       (NOTE: SUBROUTINE ASSUMES THAT THE FIRST DIMENSION              V1.1
C              OF A,B AND C IN THE CALLING PROGRAM IS L,L AND N.)       V1.1
C                                                                       V1.1
      DIMENSION A(L,1),B(L,1),C(N,1)                                    V1.1
      DO 10 I=1,N                                                       V1.1
      DO 10 J=1,M                                                       V1.1
      C(I,J) = 0.0                                                      V1.1
      DO 10 K=1,L                                                       V1.1
   10 C(I,J) = C(I,J) + A(K,I)*B(K,J)                                   V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE DOTT(A,B,C,N,M,L)                                        V1.1
C                                                  REV 01 11/20/72     V1.1
C     PERFORMS MATRIX MULTIPLICATION C = AB'                              V1.1
C     WHERE DIMENSIONS ARE A(N,L) , B(M,L) AND C(N,M).                    V1.1
C                                                                         V1.1
      DIMENSION A(N,1),B(M,1),C(N,1)                                      V1.1
      DO 10 I=1,N                                                         V1.1
      DO 10  J=1,M                                                        V1.1
      C(I,J)=0.                                                           V1.1
      DO 5  K=1,L                                                         V1.1
    5 C(I,J)= A(I,K)*B(J,K)+C(I,J)                                        V1.1
   10 CONTINUE                                                            V1.1
      RETURN                                                              V1.1
      END                                                                 V1.1
```

```
      SUBROUTINE DRCYPR (D,A,I1,I2,I3)                                  V1.1
C                                                    REV 03 07/08/74    V1.1
C     SETS UP 3X3 DIRECTION COSINE MATRIX FOR GIVEN YAW,PITCH AND ROLL. V1.1
C                                                                       V1.1
C       ARGUMENTS:                                                      V1.1
C         D: 3X3 DIRECTION COSINE MATRIX TO BE COMPUTED.                V1.1
C         A: ARRAY OF LENGTH 3 CONTAINING ROTATATION ANGLES (DEGREES).  V1.1
C        I1: AXIS OF ROTATION FOR 1ST ANGLE (1,2,3 = X,Y,Z)             V1.1
C        I2: AXIS OF ROTATION FOR 2ND ANGLE (1,2,3 = X,Y,Z)             V1.1
C        I3: AXIS OF ROTATION FOR 3RD ANGLE (1,2,3 = X,Y,Z)             V1.1
C                                                                       V1.1
      DIMENSION D(3,3),A(3),T(6,3)                                      V1.1
      RADIAN=.0174532925199433                                          V1.1
      Y = A(1)*RADIAN                                                   V1.1
      P = A(2)*RADIAN                                                   V1.1
      R = A(3)*RADIAN                                                   V1.1
      M = 6                                                             V1.1
      N = 3                                                             V1.1
      DO 10 I=1,3                                                       V1.1
      DO  5 J=1,3                                                       V1.1
      D(I,J)=0.                                                         V1.1
    5 T(I,J)=0.                                                         V1.1
      T(I,I)=1.                                                         V1.1
   10 D(I,I)=1.                                                         V1.1
      IF(Y.EQ.0.)GO TO 20                                               V1.1
      CALL ROT(T,I1,Y,M)                                                V1.1
      DO 15 I=1,3                                                       V1.1
      DO 15 J=1,3                                                       V1.1
   15 D(I,J)=T(I,J)                                                     V1 1
   20 IF(ABS(P).LT.1.E-11)GO TO 30                                      V1.2
      CALL ROT(T(4,1),I2,P,M)                                           V1.1
      CALL MAT(T(4,1),T(1,1),D(1,1),3,3,3,M,M,N)                        V1.1
      DO 25 I=1,3                                                       V1.1
      DO 25 J=1,3                                                       V1.1
   25 T(I,J)=D(I,J)                                                     V1.1
   30 IF(ABS(R).LT.1.E-11) GO TO 40                                     V1.2
      CALL ROT(T(4,1),I3,R,M)                                           V1.1
      CALL MAT(T(4,1),T(1,1),D(1,1),3,3,3,M,M,N)                        V1.1
   40 CONTINUE                                                          V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE ELIPSN(INDEX,X1,IN)                                         V1.1
C    ***********************************************                         V1.1
C                                                                            V1.1
C     THIS SUBROUTINE GENERATES 1/4 OF THE CONTOUR LINES FOR AN ELLIPSOID    V1.1
C                                                                            V1.1
C    ***********************************************                         V1.1
      DIMENSION X1(3,INDEX,INDEX),IN(INDEX)                                  V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),            V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                             V1.2
      DELTAX=SQRT(1/A(1,1,IELP))/NSTEPS(IELP)                                V1.1
      DELTAY=SQRT(1/A(2,2,IELP))/NSTEPS(IELP)                                V1.1
      SIMP1 = A(1,1,IELP)                                                    V1.1
      SIMP2 = A(2,2,IELP)                                                    V1.1
      SIMP3 = A(3,3,IELP)                                                    V1.1
      DO 101 L=1,INDEX                                                       V1.1
      X=(L-1)*DELTAX                                                         V1.1
      N=0                                                                    V1.1
      DO 50 K=1,INDEX                                                        V1.1
      Y=(K-1)*DELTAY                                                         V1.1
      TEMP = 1-X*X*SIMP1                                                     V1.1
      IF(TEMP.LT.0) TEMP=0                                               80386
      TEST = TEMP - Y*Y*SIMP2                                                V1.1
      N=N+1                                                                  V1.1
      IF(TEST.LT.0.0) GO TO 100                                              V1.1
      Z = SQRT(TEST/SIMP3)                                                   V1.1
      X1(1,N,L)=X                                                            V1.1
      X1(2,N,L)=Y                                                            V1.1
      X1(3,N,L)=Z                                                            V1.1
   50 CONTINUE                                                               V1.1
      GO TO 101                                                              V1.1
  100 Y = SQRT(TEMP/SIMP2)                                                   V1.1
      X1(1,N,L)=X                                                            V1.1
      X1(2,N,L)=Y                                                            V1.1
      X1(3,N,L)=0.0                                                          V1.1
  101 IN(L)=N                                                                V1.1
      RETURN                                                                 V1.1
      END                                                                    V1.1
```

```
      SUBROUTINE EXTEND(P,I,J)                                          V1.1
      COMMON/INTERS/ NIE(90),IE(90,90)                                  V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),       V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                        V1.2
      DIMENSION P(3,2),P3(3)                                            V1.1
      COMMON/PLTT/SFACTR,INT,TIME,ICOLOR(91),OFSETX,OFSETY,ZTIME        V1.1
      DOUBLE PRECISION ZTIME                                          80386
C        ****************************************                       V1.1
C                                                                       V1.1
C        THIS SUBROUTINE FINDS A MIDPOINT FOR A LINE THAT               V1.1
C       BEGINS ON P(1) AND ENDS ON P(2).                                V1.1
C        THIS NEW POINT IS CHECKED BY SUBROUTINE HYDE.                  V1.1
C        IF IT IS HIDDEN THEN P(I)=P3                                   V1.1
C        IF IT IS NOT HIDDEN THEN P(J)=P3                               V1.1
C        THIS ALGORITHM IS ITERATED INT TIMES.                          V1.1
C        UPON LEAVING EXTEND- P(I) WILL CONTAIN THE RESULT.             V1.1
C                                                                       V1.1
C        NOTE: P ARRAY IS CHANGED BY THIS SUBROUTINE.                   V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
      DO 3 IN=1,INT                                                     V1.1
      DO 1 L=1,3                                                        V1.1
    1 P3(L)=(P(L,2)+P(L,1))/2.0                                         V1.1
      NUM=NIE(IELP)                                                     V1.1
      DO 2 IM=1,NUM                                                     V1.1
      KK=IE(IM,IELP)                                                    V1.1
      IF(KK.LE.30) CALL HYDE(KK,P3,IFLAG)                               V1.1
      IF(KK.GT.30) CALL HIDE(KK,P3,IFLAG)                               V1.1
      IF(IFLAG.EQ.1) GO TO 10                                           V1.1
    2 CONTINUE                                                          V1.1
   10 N=I                                                               V1.1
      IF(IFLAG.EQ.1) N=J                                                V1.1
      DO 3 L=1,3                                                        V1.1
    3 P(L,N)=P3(L)                                                      V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE GENDCM(CAMERA,FOCUS,D,ICODE)                                V1.2
C    ********************************************                            V1.1
C     THIS SUBROUTINE GENERATES A DIRECTION COSINE MATRIX.                   V1.1
C                                                                            V1.1
      DIMENSION CAMERA(3),FOCUS(3),Z(3),D(3,3)                               V1.1
      SUM = 0.0                                                              V1.1
      SI=1.0                                                                 V1.2
      IF (FOCUS(1).NE.CAMERA(1).OR.FOCUS(2).NE.CAMERA(2)) GOTO 50            V1.2
      SI=SIGN(1.,CAMERA(3)-FOCUS(3))                                         V1.2
      DO 40 I=1,3                                                            V1.1
      DO 40 J=1,3                                                            V1.1
      D(I,J)=0.0                                                             V1.1
40    CONTINUE                                                               V1.1
      D(1,1)=SI                                                              V1.2
      D(2,2)=1.                                                              V1.2
      D(3,3)=SI                                                              V1.2
      GO TO 999                                                              V1.1
50    IF (ICODE.LT.0) SI=-1.0                                                V1.2
C                                                                            V1.1
      DO 100  I=1,3                                                          V1.1
      Z(I) = FOCUS(I) - CAMERA(I)                                            V1.1
  100 SUM = SUM + Z(I)*Z(I)                                                  V1.1
      SUM = SQRT(SUM)                                                        V1.1
      DO 200  I=1,3                                                          V1.1
  200 Z(I) = Z(I)/SUM                                                        V1.1
C                                                                            V1.1
      XNORM = SQRT(Z(1)*Z(1) + Z(2)*Z(2))                                    V1.1
C                                                                            V1.1
C FILL IN FIRST ROW OF D                                                     V1.1
C                                                                            V1.1
       D(1,1) = Z(2)/XNORM*SI                                                V1.2
      D(1,2) = -Z(1)/XNORM*SI                                                V1.2
      D(1,3) = 0.0                                                           V1.1
C                                                                            V1.1
C FILL IN SECOND ROW OF D                                                    V1.1
C                                                                            V1.1
      D(2,1) = Z(1)*Z(3)/XNORM*SI                                            V1.2
      D(2,2) = Z(2)*Z(3)/XNORM*SI                                            V1.2
      D(2,3) = -XNORM*SI                                                     V1.2
C                                                                            V1.1
C FILL IN THIRD ROW OF D                                                     V1.1
C                                                                            V1.1
      DO 300  I=1,3                                                          V1.1
  300 D(3,I) = Z(I)                                                          V1.1
999   CONTINUE                                                               V1.1
      RETURN                                                                 V1.1
      END                                                                    V1.1
```

```
      SUBROUTINE HIDE(KK,P3,IFLAG)                                      V1.1
      COMMON/POLYGON/NPLANE,KFLAG,NPPP(90),P0(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),       V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLP0(3,90)                        V1.2
      DIMENSION P7(2) ,PP(3)                                            V1.1
      DIMENSION P3(3),P4(3)                                             V1.1
      REAL PPRIME(3),NPRIME(3)                                          V1.1
      CALL TRANS1(P3,P4)                                                V1.1
      P7(1)=P4(1)/P4(3)                                                 V1.1
      P7(2)=P4(2)/P4(3)                                                 V1.1
      CALL TPOINT(P7,KK,IFLAG)                                          V1.1
      IF(IFLAG.EQ.2) RETURN                                             V1.1
C                                                                       V1.1
C          POINT IS INSIDE POLYGON CHECK TO SEE                         V1.1
C        IF POLYGON OR POINT IS CLOSER TO VIEWPOINT.                    V1.1
C                CALCULATE TAU.                                         V1.1
C                                                                       V1.1
      DO 5 I=1,3                                                        V1.1
      PPRIME(I)=D(1,I,KK)                                               V1.1
      IF (ABS(PPRIME(I)).LT.1.E-11) PPRIME(I)=.000001                   V1.2
5     CONTINUE                                                          V1.1
      CALL MAT(DVP,PPRIME,NPRIME,3,3,1,3,3,3)                           V1.1
      DO 10 J=1,3                                                       V1.1
   10 PP(J)=P(J,1,KK-30)-VP(J)                                          V1.1
      CALL MAT(DVP,PP,PPRIME,3,3,1,3,3,3)                               V1.1
      CALL DOT(NPRIME,PPRIME,P5,1,1,3)                                  V1.1
      CALL DOT(NPRIME,P4,P6,1,1,3)                                      V1.1
      IFLAG=2                                                           V1.1
      IF(P5/P6.GE..99999999) RETURN                                     V1.1
      IFLAG=1                                                           V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE HYDE(N,R,IFLAG)                                          V1.1
C                                                                         V1.1
C        ***************************************                          V1.1
C                                                                         V1.1
C        SUBROUTINE HYDE DETERMINES IF A POINT IS HIDDEN BY               V1.1
C         ANOTHER ELLIPSOID.                                              V1.1
C                                                                         V1.1
C        ***************************************                          V1.1
C        ****************************************                         V1.1
C        N= POSSIBLE HIDING ELLIPSOID NUMBER.                             V1.1
C        R= VECTOR TO PLOTTING POINT.                                     V1.1
C        IFLAG= FLAG THAT INDICATES HIDDEN LINE OR NOT.                   V1.1
C             IFLAG = 2 = NOT HIDDEN                                      V1.1
C             IFLAG = 1 = HIDDEN                                          V1.1
C        ****************************************                         V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,AA(3,3,30),SEGLP(3,90),VP(3),        V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                          V1.2
      DIMENSION P1(3),P2(3),R2(3),S(3),V(3)                               V1.1
      DIMENSION MU(3),M(3,2),P(3),SON(3),SOI(3)                           V1.2
      DIMENSION DD(3,3),VP1(3)                                            V1.1
      DIMENSION R(3)                                                      V1.1
      REAL M , MU , MAG                                                   V1.1
C        ASSUME NOT HIDDEN.                                               V1.1
      IFLAG=2                                                             V1.1
C                                                                         V1.1
C   *****************************************************************     V1.1
C                                                                         V1.1
C        PUT SEGLP(N) IN N'S FRAME.                                       V1.1
C        PUT SEGLP(M) IN N'S FRAME.                                       V1.1
C        PUT R2 IN N'S FRAME.                                             V1.1
C        PUT VIEW POINT IN N'S FRAME.                                     V1.1
C                                                                         V1.1
C   *****************************************************************     V1.1
      DO 4 I=1,3                                                          V1.2
      SON(I) = SEGLP(I,N) + SEGLPO(I,N)                                   V1.2
4     SOI(I) = SEGLP(I,IELP) + SEGLPO(I,IELP)                             V1.2
      CALL MAT(D(1,1,N),SON,P1,3,3,1,3,3,3)                               V1.2
      CALL MAT(D(1,1,N),SOI,P2,3,3,1,3,3,3)                               V1.2
      IF(IELP .LE. 30)  GO TO 55                                          V1.1
      DO 56  I=1,3                                                        V1.1
      DO 56  J=1,3                                                        V1.1
   56 DD(I,J) = D(I,J,N)                                                  V1.1
      GO TO 57                                                            V1.1
   55 CONTINUE                                                            V1.1
      CALL DOTT(D(1,1,N),D(1,1,IELP),DD,3,3,3)                            V1.1
   57 CONTINUE                                                            V1.1
      CALL MAT(DD,R,R2,3,3,1,3,3,3)                                       V1.1
      CALL MAT(D(1,1,N),VP,VP1,3,3,1,3,3,3)                               V1.1
      MAG = 0.0                                                           V1.1
C                                                                         V1.1
C   ** ************************************************************       V1.1
C                                                                         V1.1
```

```
C         FIND VECTORS S,V,AND MU.                                      V1.1
C         MU WILL BECOME A UNIT VECTOR IN VECTOR M'S DIRECTION          V1.1
C           OR IN M'S OPPOSITE DIRECTION.                               V1.1
C                                                                       V1.1
C     ****************************************************************  V1.1
C                                                                       V1.1
      DO 1 I=1,3                                                        V1.1
      S(I) = P2(I) + R2(I) - P1(I)                                      V1.1
      V(I) = VP1(I) - P1(I)                                             V1.1
      MU(I) = S(I) - V(I)                                               V1.1
    1 MAG = MAG + MU(I)**2                                              V1.1
      MAG = SQRT(MAG)                                                   V1.1
C                                                                       V1.1
C     ****************************************************************  V1.1
C                                                                       V1.1
C         MAKE MU A UNIT VECTOR.                                        V1.1
C                                                                       V1.1
C     ****************************************************************  V1.1
C                                                                       V1.1
      DO 2 I=1,3                                                        V1.1
    2 MU(I) = MU(I) / MAG                                               V1.1
      A = AA(1,1,N)                                                     V1.1
      B = AA(2,2,N)                                                     V1.1
      C = AA(3,3,N)                                                     V1.1
      IF(ABS(MU(1)).GT..000000001) GO TO 10                             V1.1
      IF(ABS(MU(2)).GT..000000001) GO TO 20                             V1.1
      CALL Z(MU,A,B,C,S,M,JFLAG)                                        V1.1
   30 IF(JFLAG.EQ.1) RETURN                                             V1.1
C                                                                       V1.1
C     ****************************************************************  V1.1
C                                                                       V1.1
C         FIND P AND COMPARE M TO P TO DETERMINE WHAT POINT             V1.1
C          IS CLOSER TO THE VIEW POINT.                                 V1.1
C                                                                       V1.1
C     ****************************************************************  V1.1
C                                                                       V1.1
      DO 3 I=1,3                                                        V1.1
    3 P(I)=  S(I) - V(I) - M(I,1)                                       V1.1
      CALL DOT(P,M(1,1),RESLT1,1,1,3)                                   V1.1
      CALL DOT(P,M(1,2),RESLT2,1,1,3)                                   V1.1
      IF(N.EQ.IELP) GO TO 400                                           V1.1
      IF(RESLT1.GT.0.000000001) IFLAG=1                                 V1.1
   41 IF(RESLT2.GT.0.000000001) IFLAG=1                                 V1.1
      RETURN                                                            V1.1
   10 CALL XYZ(MU,A,B,C,S,M,JFLAG)                                      V1.1
      GO TO 30                                                          V1.1
   20 CALL YZ(MU,A,B,C,S,M,JFLAG)                                       V1.1
      GO TO 30                                                          V1.1
  400 IF(ABS(RESLT2).GT.ABS(RESLT1)) GO TO 41                           V1.1
      RESLT2=RESLT1                                                     V1.1
      GO TO 41                                                          V1.1
      RETURN                                                            V1.1
```

```
      END                                                        V1.1
```

```
      SUBROUTINE INPUT(CTIME)                                                 V1.1
      COMMON/PLTT/SFACTR,INT,TIME,ICOLOR(91),OFSETX,OFSETY,ZTIME              V1.1
      COMMON/INTERS/ NIE(90),IE(90,90)                                        V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),             V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                              V1.2
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),PO(3,4,60),P(3,4,60),              V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                       V1.1
      COMMON/ATB/PL(17,30)                                                    V1.1
      DIMENSION BD(24,40)                                                     V1.1
      DIMENSION DD(3)                                                         V1.1
      COMMON/DBUG/IDEBUG(80),NISG,DEVFLG,ONLINE,TERM,BDRS,OFLINE              V1.1
      COMMON/VIEWP/VPO(3),DVPO(3,3),IVP,VP2(3)                                V1.1
      COMMON/CONECT/ NP,MPL(3,5,60)                                           V1.1
      COMMON /REMOVE/NPREM,IREMOV(30)                                         V1.1
      DOUBLE PRECISION CTIME,ZTIME                                            V1.1
      INTEGER DEVFLG,ONLINE,TERM,BDRS,OFLINE                                80386
      IF(IFLAG.NE.1) GO TO 600                                                V1.1
      READ(5,70) NFAST,NPREM,NISG                                             V1.1
      WRITE(6,70) NFAST,NPREM,NISG                                            V1.1
      READ(5,72)(IREMOV(I),I=1,NPREM)                                         V1.1
      WRITE(6,72)(IREMOV(I),I=1,NPREM)                                        V1.1
72    FORMAT(3(40I2/))                                                        V1 1
      READ(1,END=800) NSEG,NP,PL,BD, (((MPL(I,J,K),I=1,3),  J=1,5),K          V1
     *=1,30)                                                                  V1.1
C                                                                             V1.1
   39 READ(1,END=700) TIME, ((SEGLP(I,J), I=1,3), J=1,30),                    V1.1
     *         (((D(I,J,K), I=1,3), J=1,3), K=1,30)                           V1.1
      ITIME=TIME*1000000.+.5                                                  V1.1
      ZTIME=ITIME/1000000.D0                                                  V1.1
C                                                                             V1.1
70    FORMAT(3I2)                                                             V1.1
      IF(ZTIME.LT.CTIME) GO TO 39                                             V1.1
      READ(5,40) NSP                                                          V1.1
   40 FORMAT(I2)                                                              V1.1
      IF(NSP.EQ.0) GO TO 46                                                   V1.1
      DO 45 L=1,NSP                                                           V1.1
      K=NP+L                                                                  V1.1
      II=30+NP+L                                                              V1.1
      READ(5,41) NPPP(II),MPL(1,1,K)                                          V1.1
   41 FORMAT(I1,I2)                                                           V1.1
      NSIDES=NPPP(II)                                                         V1.1
      DO 45 J=1,NSIDES                                                        V1.1
      READ(5,42) (PO(I,J,K),I=1,3)                                            V1.1
   42 FORMAT(3F10.0)                                                          V1.1
   45 CONTINUE                                                                V1.1
   46 NPLANE=NP+NSP                                                           V1.1
      DO 100 J=1,NSEG                                                         V1.1
      DO 100 I=1,3                                                            V1.1
  100 A(I,I,J)=1.0/BD(I,J)**2                                                 V1.1
      DO 200 J=1,NSEG                                                         V1.1
      CALL DOT(D(1,1,J),BD(4,J),DD,3,1,3)                                     V1.1
      DO 200 I=1,3                                                            V1.1
```

```
  200 SEGLPO(I,J)= DD(I)                                                   V1.2
      IF(IDEBUG(3).EQ.1) WRITE(6,6) NSEG,NPLANE                            V1.1
    6 FORMAT(1H1,'NUMBER OF SEGMENTS = ',I2,',  NUMBER OF PLANES = ',I2)   V1.1
      NSEG = NSEG-NFAST                                                    V1.1
      READ(5,301) (ICOLOR(I),I=1,30)                                       V1.1
  301 FORMAT(8(5X,I5))                                                     V1.1
      II=NPLANE+30                                                         V1.1
      READ(5,301) (ICOLOR(I),I=31,90)                                      V1.1
      READ(5,301) ICOLOR(91)                                               V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,71) NSEG                                  V1.1
   71 FORMAT(1X,'THE NUMBER OF SEGMENTS TO  BE PLOTTED = ',I2)             V1.1
      READ(5,1) (NSTEPS(IPP),IPP=1,NSEG)                                   V1.1
      READ(5,1)  (NSTEPS(IPP+30),IPP=1,NPLANE)                             V1.1
    1 FORMAT(30I2)                                                         V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,2) (NSTEPS(IPP),IPP=1,NSEG)               V1.1
    2 FORMAT(10X,'NUMBER OF DIVISIONS ALONG A RADIUS',/2X,30I3)            V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,55) (NSTEPS(IPP+30),IPP=1,NPLANE)         V1.1
   55 FORMAT(10X,'NUMBER OF DIVISIONS ALONG A SIDE ',/2X,30I3)             V1.1
      READ(5,11) INT,SFACTR                                                V1.1
   11 FORMAT(I3,7X,F10.2)                                                  V1.1
      WRITE(6,11) INT,SFACTR                                               V1.1
      READ(5,901) OFSETX,OFSETY                                            V1.1
      WRITE(6,901) OFSETX,OFSETY                                           V1.1
901   FORMAT(2F10.0)                                                       V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,902) OFSETX,OFSETY                        V1.1
902   FORMAT(1X,'OFSETX= ',F10.3,4X,'OFSETY= ',F10.3)                      V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,12) SFACTR,INT                            V1.1
   12 FORMAT(1X,'SCALE FACTOR = ',F10.2,2X,' ITERATION NUMBER = ',I3)      V1.1
      READ(5,13) VP,RA,IVP,ICODE                                           V1.1
   13 FORMAT(6F10.0,2I10)                                                  V1.1
C                                                                          V1.1
C  ICODE = 0 :  ROLL, PITCH, AND YAW ANGLES ARE SUPPLIED IN RA ARRAY.      V1.1
C                                                                          V1.1
C  ICODE = 1 : DIRECTION COSINE MATRIX SUPPLIED AS INPUT.RA ARRAY IS 1ST   V1.1
C              ROW OF MATRIX.THE NEXT CARD CONTAINS THE 2ND AND 3RD ROWS   V1.1
C                                                                          V1.1
C  ICODE = 2 :  POINT AT WHICH VIEWPOINT Z-AXIS IS TO AIM IS SUPPLIED      V1.1
C               IN RA ARRAY.                                               V1.1
C                                                                          V1.1
C  ICODE =-2 :  SAME AS ICODE=2, EXCEPT THE POSITIVE Z-AXIS IN THE ATB     V1.2
C               SIMULATION IS UP.                                          V1.2
C                                                                          V1.1
      IF(ICODE .NE. 0)  GO TO 500                                          V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,4) VP,RA                                  V1.1
    4 FORMAT(1X,'VIEWPOINT VECTOR (',F10.1,',',F10.1,',',F10.1,')'/1X      V1.1
     1'ROTATION OF VIEWPOINT RELATIVE TO INERTIAL COORDINATE SYSTEM'/1X    V1.1
     2'THESE ROTATIONS MUST BE DETERMINED BY PERFORMING ROLL MOTION FIRS   V1.1
     3T'/1X'THEN A PITCH MOTION AND THEN THE YAW MOTION'/10X               V1.1
     4'ROLL = ',F10.1,1X,'DEG.',5X,'PITCH = ',F10.1,1X,'DEG.',             V1.1
     55X,'YAW = ',F10.1,1X,'DEG.')                                         V1.1
      CALL DRCYPR(DVP,RA,1,2,3)                                            V1.1
      GO TO 550                                                            V1.1
```

```
  500 IF (IABS(ICODE).EQ.2) CALL GENDCM(VP,RA,DVP,ICODE)                 V1.2
      IF (IABS(ICODE).EQ.2) GO TO 550                                    V1.2
      DO 501 JJJ=1,3                                                     V1.1
  501 DVP(1,JJJ) = RA(JJJ)                                               V1.1
      READ(5,13) ((DVP(I,J),J=1,3),I=2,3)                                V1.1
      WRITE(6,13)((DVP(I,J),J=1,3),I=2,3)                                V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,15) (VP(I),I=1,3)                       V1.1
   15 FORMAT(' VIEW POINT VECTOR   (',F10.1,',',F10.1,',',F10.1,').',/,  V1.1
     -  ' VIEW POINT ORIENTATION DEFINED IN DIRECTION COSINE MATRIX FORM V1.1
     -.')                                                                V1.1
  550 CONTINUE                                                           V1.1
      DO 80 J=1,3                                                        V1.1
      VPO(J)=VP(J)                                                       V1.1
      DO 80 I=1,3                                                        V1.1
   80 DVPO(J,I)=DVP(J,I)                                                 V1.1
      IF(IFLAG .NE. 1)  RETURN                                           V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,60)                                     V1.1
   60 FORMAT(1X,'********************'/,1X,                              V1.1
     1'VIEWPOINT DIRECTION COSINE MATRIX')                               V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,53)((DVP(I,J),J=1,3),I=1,3)             V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,54)                                     V1.1
      DO 20 IKE=1,NSEG                                                   V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,50) IKE,(SEGLP(I,IKE),I=1,3)            V1.1
   50 FORMAT(1X,'********************'/1X'SEGMENT # ',I3,5X,'SEGLP = ('  V1.1
     -F10.3,2(',',F10.3),','//,1X,'A MATRIX',T50,'DIRECTION COSINE MATRIX V1.1
     -  '/)                                                              V1.1
      DO 400  III=1,3                                                    V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,51) (A(III,J,IKE),J=1,3),(D(III,J,IKE), V1.1
     +J=1,3)                                                             V1.1
  400 CONTINUE                                                           V1.1
   51 FORMAT(3(2X,F8.5),T50,3(2X,F9.6))                                  V1.1
   53 FORMAT(3(2X,F9.6))                                                 V1.1
      IF(IDEBUG(3).EQ.1) WRITE(6,54)                                     V1.1
   54 FORMAT(1X,/,1X'********************')                              V1.1
   20 CONTINUE                                                           V1.1
      RETURN                                                             V1.1
600   CONTINUE                                                           V1.1
      IF(ZTIME.LT.CTIME) GO TO 675                                       V1.1
      IF(ISW1.EQ.0) GO TO 680                                            V1.1
      DO 650 J=1,NSEG                                                    V1.1
      CALL DOT(D(1,1,J),BD(4,J),DD,3,1,3)                                V1.1
      DO 650 I=1,3                                                       V1.1
  650 SEGLPO(I,J)= DD(I)                                                 V1.2
      ISW1=0                                                             V1.1
      IFLAG=5                                                            V1.1
      RETURN                                                             V1.1
  675 READ(1,END=700) TIME,((SEGLP(I,J),I=1,3),J=1,30),                  V1.1
     *        (((D(I,J,K), I=1,3), J=1,3), K=1,30)                       V1.1
      ITIME=TIME*1000000.+.5                                             V1.1
      ZTIME=ITIME/1000000.D0                                             V1.1
C                                                                        V1.1
      ISW1=1                                                             V1.1
```

```
      GO TO 600                                                          V1.1
  700 WRITE(6,720)                                                       V1.1
  720 FORMAT(1X,'END OF DATA REACHED.')                                  V1.1
      ISW1=1                                                             V1.1
      STOP                                                               V1.1
  800 WRITE(6,820)                                                       V1.1
  820 FORMAT(1X,'NO DATA ON TAPE.')                                      V1.1
      STOP                                                               V1.1
  680 IFLAG=10                                                           V1.1
      RETURN                                                             V1.1
      END                                                                V1.1
```

```
      SUBROUTINE LSEGINT(P1,P2,R1,R2,IFLAG)                                V1.1
C                                                                          V1.1
C THIS SUBROUTINE DETERMINES IF TWO LINE SEGMENTS, P1P2 AND R1R2,          V1.1
C   INTERSECT.                                                             V1.1
C ALL PARALLEL LINE SEGMENTS,WHETHER COINCIDENT OR NOT, ARE                V1.1
C   CONSIDERED TO BE NON-INTERSECTING.                                     V1.1
C CASE 1 IS CONSIDERED TO BE THE REGULAR CONFIGURATION.                    V1.1
C THE SPECIAL CASES ARE AS FOLLOWS:                                        V1.1
C  2)  ONE LINE IS VERTICAL                                                V1.1
C  3)  BOTH LINES ARE VERTICAL                                             V1.1
C  4)  BOTH LINES ARE HORIZONTAL                                           V1.1
C  5)  BOTH LINES HAVE THE SAME NON-ZERO SLOPE                             V1.1
C  6)  ONE LINE IS VERTICAL, THE OTHER IS HORIZONTAL                       V1.1
C                                                                          V1.1
C                                                                          V1.1
C IFLAG = 1 INDICATES INTERSECTION; IFLAG = 0 INDICATES NO INTERSECTION.   V1.1
C                                                                          V1.1
      DIMENSION  P1(2),P2(2),R1(2),R2(2),P(4,2),T(2)                       V1.1
      REAL M(2)                                                            V1.1
      IFLAG=0                                                              V1.1
C                                                                          V1.1
C  SET UP ARRAYS                                                           V1.1
      DO 1  I=1,2                                                          V1.1
      P(1,I) = P1(I)                                                       V1.1
      P(2,I) = P2(I)                                                       V1.1
      P(3,I) = R1(I)                                                       V1.1
    1 P(4,I) = R2(I)                                                       V1.1
C                                                                          V1.1
C  DETERMINE IF CASE 3                                                     V1.1
      IF(ABS(P(1,1)-P(2,1)).LT.1.E-11.AND.ABS(P(3,1)-P(4,1)).LT.           V1.1
     +1.E-11) RETURN                                                       V1.1
C                                                                          V1.1
C  DETERMINE IF CASE 4                                                     V1.1
      IF(ABS(P(1,2)-P(2,2)).LT.1.E-11.AND.ABS(P(3,2)-P(4,2)).LT.           V1.1
     +1.E-11) RETURN                                                       V1.1
C                                                                          V1.1
C  DETERMINE IF CASE 6                                                     V1.1
      DO 2  I=1,2                                                          V1.1
      J = 3-I                                                              V1.1
      IF(ABS(P(1,I)-P(2,I)).LT.1.E-11.AND.ABS(P(3,J)-P(4,J)).LT.           V1.1
     +1.E-11) GO TO 10                                                     V1.1
    2 CONTINUE                                                             V1.1
C                                                                          V1.1
C  DETERMINE IF CASE 2                                                     V1.1
      IF(ABS(P(1,1)-P(2,1)).LT.1.E-11.OR.ABS(P(3,1)-P(4,1)).LT.            V1.1
     +1.E-11) GO TO 6                                                      V1.1
      GO TO 5                                                              V1.1
    6 DO 3  I=1,4                                                          V1.1
      TEMP = P(I,1)                                                        V1.1
      P(I,1) = P(I,2)                                                      V1.1
    3 P(I,2) = TEMP                                                        V1.1
C                                                                          V1.1
```

```
C  REGULAR PROCEDURE                                                      V1.1
    5 DO 4  I=1,2                                                          V1.1
      I1 = 2*I                                                             V1.1
      I2 = 2*I - 1                                                         V1.1
    4 M(I) = (P(I1,2) - P(I2,2))/(P(I1,1) - P(I2,1))                       V1.1
C                                                                          V1.1
C  CHECK FOR CASE 5                                                        V1.1
      IF(ABS(M(1)-M(2)).LT.1.E-11) RETURN                                  V1.1
      X = (P(3,2) - P(1,2) + M(1)*P(1,1) - M(2)*P(3,1))/(M(1) - M(2))      V1.1
      DO 7  I=1,2                                                          V1.1
    7 T(I) = (X - P(2*I-1,1))/(P(2*I,1) - P(2*I-1,1))                      V1.1
   20 IF(T(1).GT.0 .AND.  T(2).GT.0 .AND. T(1).LT.1 .AND. T(2).LT.1)       V1.1
     -   IFLAG=1                                                           V1.1
      RETURN                                                               V1.1
C                                                                          V1.1
C  CASE 6 PROCEDURE                                                        V1.1
   10 IF(ABS(P(1,1)-P(2,1)).LT.1.E-11) GO TO 11                            V1.1
      J=1                                                                  V1.1
      I=2                                                                  V1.1
      GO TO 12                                                             V1.1
   11 I=1                                                                  V1.1
      J=2                                                                  V1.1
   12 T(1) = (P(3,J) - P(1,J))/(P(2,J) - P(1,J))                           V1.1
      T(2) = (P(1,I) - P(3,I))/(P(4,I) - P(3,I))                           V1.1
      GO TO 20                                                             V1.1
      END                                                                  V1.1
```

```
      SUBROUTINE MAT(A,B,C,LL,MM,NN,JA,JB,JC)                       V1.1
C                                                 REV 03 05/31/73   V1.1
C     PERFORMS MATRIX MULTIPLICATION C - AB.                        V1.1
C                                                                   V1.1
C       ARGUMENTS:                                                  V1.1
C         A: MATRIX OF SIZE (L,M).                                  V1.1
C         B: MATRIX OF SIZE (M,N).                                  V1.1
C         C: PRODUCT MATRIX OF SIZE (L,N).                          V1.1
C         L,M,N: SIZES OF MATRICES A,B,C.                           V1.1
C         LA,LB,LC: 1ST DIMENSION OF A,B,C IN CALLING PROGRAM.      V1.1
C                                                                   V1.1
      DIMENSION  A(JA,1),B(JB,1),C(JC,1)                            V1.1
      DO 20 L=1,LL                                                  V1.1
      DO 10 N=1,NN                                                  V1.1
      S = 0.0                                                       V1.1
      DO 5 M=1,MM                                                   V1.1
    5 S=S+A(L,M)*B(M,N)                                             V1.1
      C(L,N)=S                                                      V1.1
   10 CONTINUE                                                      V1.1
   20 CONTINUE                                                      V1.1
      RETURN                                                        V1.1
      END                                                           V1.1
```

```
      SUBROUTINE NFRAME                                              V1.1
C                                                                    V1.1
C THIS ROUTINE PERFORMS THE END OF FRAME HANDLING FOR THE BDRS        V1.1
C                                                                    V1.1
      COMMON/DEVICE/IDEF,IOPORT,MODEL                               80386
      INTEGER*2 ENDFRA,MASK,STATUS                                   V1.1
      DATA ENDFRA,MASK/Z'FFFF',Z'FFFF'/                             80386
C     CALL DOLWH(8,1,ENDFRA,MASK,STATUS)                            80386
C     CALL PLOTS(M,N,LU)                                            80386
      CALL PLOT(0.0,0.0,-999)                                       80386
      RETURN                                                         V1.1
      END                                                            V1.1
```

```
      SUBROUTINE OVERLAP(III,KKK,MFLAG)                                 V1.1
      DIMENSION P1(2),P2(2),R1(2),R2(2)                                 V1.1
      DIMENSION PP2(2)                                                  V1.1
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),P0(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
C                                                                       V1.1
C     OVERLAP TAKES OBJECTS I AND K AND TESTS FOR ANY OVERLAP ON THE    V1.1
C     PROJECTION PLANE.                                                 V1.1
C     MFLAG WILL BE RETURNED TO INDICATE IF OVERLAP OR NOT.             V1.1
C          MFLAG=0 MEANS NO OVERLAP                                     V1.1
C          MFLAG=1 MEANS OVERLAP                                        V1.1
C                                                                       V1.1
      I = III                                                           V1.1
      K = KKK                                                           V1.1
    5 CONTINUE                                                          V1.1
      DO 10  J=1,2                                                      V1.1
   10 PP2(J) = POS(J,K)                                                 V1.1
C                                                                       V1.1
C     GO AROUND THE RINGS                                               V1.1
C                                                                       V1.1
      NPTS1 = NPPP(I)                                                   V1.1
      NPTS2 = NPPP(K)                                                   V1.1
      DO 200  J=1,NPTS2                                                 V1.1
      CALL TPOINT(PP2,I,MFLAG)                                          V1.1
      IF(MFLAG.EQ.1) RETURN                                             V1.1
      DO 200 N=1,2                                                      V1.1
  200 PP2(N) = PP2(N) + CONVEC(N,J,K)                                   V1.1
C                                                                       V1.1
C        CHECKED ALL POINTS AND FOUND THEY WERE ALL OUTSIDE.            V1.1
C                                                                       V1.1
C  NEXT, CHECK FOR INTERSECTING LINE SEGMENTS.                          V1.1
C                                                                       V1.1
      DO 60  II=1,2                                                     V1.1
      P1(II) = POS(II,I)                                                V1.1
   60 R1(II) = POS(II,K)                                                V1.1
      DO 61  L=1,NPTS1                                                  V1.1
      DO 62  II=1,2                                                     V1.1
   62 P2(II) = P1(II) + CONVEC(II,L,I)                                  V1.1
      DO 63  J=1,NPTS2                                                  V1.1
      DO 64  II=1,2                                                     V1.1
   64 R2(II) = R1(II) + CONVEC(II,J,K)                                  V1.1
      CALL LSEGINT(P1,P2,R1,R2,MFLAG)                                   V1.1
      IF(MFLAG .EQ. 1)  RETURN                                          V1.1
      R1(1) = R2(1)                                                     V1.1
   63 R1(2) = R2(2)                                                     V1.1
      P1(1) = P2(1)                                                     V1.1
   61 P1(2) = P2(2)                                                     V1.1
      IF(I .NE. III)  RETURN                                            V1.1
      I = KKK                                                           V1.1
      K = III                                                           V1.1
      GO TO 5                                                           V1.1
      END                                                               V1.1
```

```
      SUBROUTINE PLPLN(SEG,INDEX2)                                          V1.1
C    ********************************************                          V1.1
C                                                                           V1.1
C     THIS SUBROUTINE PLOTS THE PLANES.                                     V1.1
C                                                                           V1.1
C    ********************************************                          V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,AA(3,3,30),SEGLP(3,90),VP(3),          V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                            V1.2
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),PO(3,4,60),P(3,4,60),            V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                     V1.1
      COMMON/DBUG/IDEBUG(80),NISG,DEVFLG,ONLINE,TERM,BDRS,OFLINE            V1.1
      DIMENSION SEG(3,3333)                                                 V1.1
      INTEGER DEVFLG,ONLINE,TERM,BDRS,OFLINE                                V1.1
      COMMON/PLTT/SFACTR,INT,TIME,ICOLOR(91),OFSETX,OFSETY,ZTIME            V1.1
      COMMON /REMOVE/NPREM,IREMOV(30)                                       V1.1
      DOUBLE PRECISION ZTIME                                              80386
      IF(NPLANE .EQ. 0)  RETURN                                             V1.1
      SEG(1,1) = 0.0                                                        V1.1
      SEG(2,1) = 0.0                                                        V1.1
      SEG(3,1) = 0.0                                                        V1.1
      DO 500  LL=1,NPLANE                                                   V1.1
      DO 100 I=1,NPREM                                                      V1.1
      IF (LL.EQ.IREMOV(I)) GO TO 500                                        V1.1
100   CONTINUE                                                              V1.1
      L = LL + 30                                                           V1.1
      IF(DEVFLG.EQ.OFLINE.OR.DEVFLG.EQ.BDRS) CALL COLOR(ICOLOR(L),IERR) 80386
      NUM = NPPP(L)*NSTEPS(L) + 1                                           V1.1
      A = 1./NSTEPS(L)                                                      V1.1
      NSIDES = NPPP(L)                                                      V1.1
      DO 400  K=1,NSIDES                                                    V1.1
      KK = K + 1                                                            V1.1
      IF(K .EQ. NSIDES)  KK=1                                               V1.1
      I1 = (K-1)*NSTEPS(L) + 2                                              V1.1
      I2 = I1 + NSTEPS(L) - 1                                               V1.1
      DO 400  I=I1,I2                                                       V1.1
      DO 400  J=1,3                                                         V1.1
  400 SEG(J,I) = SEG(J,I-1) + A*(P(J,KK,LL)-P(J,K,LL))                      V1.1
      IPEN = 3                                                              V1.1
      IELP = L                                                              V1.1
      CALL PNTPLT(SEG(1,1),IPEN,INDEX2,NUM)                                 V1.1
  500 CONTINUE                                                              V1.1
      RETURN                                                                V1.1
      END                                                                   V1.1
```

```
      SUBROUTINE PNTPLT(SEG,IPEN,INDEX2,NPTS)                              V1.1
C    ********************************************                          V1.1
C                                                                          V1.1
C     POINT PLOT SUBROUTINE.                                               V1.1
C                                                                          V1.1
C    ********************************************                          V1.1
      COMMON/PLTT/SFACTR,INT,TIME,ICOLOR(91),OFSETX,OFSETY,ZTIME           V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),          V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                           V1.2
      COMMON/INTERS/ NIE(90),IE(90,90)                                     V1.1
      DOUBLE PRECISION ZTIME                                              80386
      DIMENSION P(3),PP(3,2),PPP(3)                                        V1.1
      DIMENSION SEG(3,3333)                                                V1.1
      DATA YMIN/0.0/,YMAX/11.0/,IPLOT/1/                                   V1.1
      DATA IFIRST/0/                                                       V1.1
      DATA ITWO/2/,ITHREE/3/                                               V1.1
      IF (IFIRST.EQ.0) READ(5,1000)XMIN,XMAX                               V1.1
 1000 FORMAT(2F10.2)                                                       V1.1
      IF (IFIRST.EQ.0) WRITE(6,1001)XMIN,XMAX                              V1.1
 1001 FORMAT(' XMIN,XMAX=',2(1X,F10.3))                                    V1.1
      IFIRST=1                                                             V1.1
      LFLAG=2                                                              V1.1
      IFLAG=2                                                              V1.1
      NEWPEN=0                                                             V1.1
      DO 100 IPNT=1,NPTS                                                   V1.1
      INUM=NIE(IELP)                                                       V1.1
      IF(INUM.EQ.0) GO TO 61                                               V1.1
      DO 60 K=1,INUM                                                       V1.1
      KK=IE(K,IELP)                                                        V1.1
      IF(KK.LE.30) CALL HYDE(KK,SEG(1,IPNT),IFLAG)                         V1.1
      IF(KK.GT.30) CALL HIDE(KK,SEG(1,IPNT),IFLAG)                         V1.1
      IF(IFLAG.EQ.1) GO TO 61                                              V1.1
   60 CONTINUE                                                             V1.1
   61 IF(K.GT.INUM .OR. K.EQ.1)  GO TO 62                                  V1.1
      ITEMP = IE(1,IELP)                                                   V1.1
      IE(1,IELP) = IE(K,IELP)                                              V1.1
      IE(K,IELP) = ITEMP                                                   V1.1
   62 IF(IFLAG .NE. LFLAG)  THEN                                          80386
         IF(IPNT.EQ.1) GO TO 70                                           80386
         DO 250 IJ=1,3                                                    80386
         PP(IJ,1)=SEG(IJ,IPNT-1)                                          80386
  250    PP(IJ,2)=SEG(IJ,IPNT)                                            80386
         CALL EXTEND(PP,IFLAG,LFLAG)                                      80386
         DO 260 IJ=1,3                                                    80386
  260    P(IJ)=PP(IJ,IFLAG)                                               80386
         CALL TRANS1(P,PPP)                                               80386
         X=-PPP(1)*SFACTR/PPP(3)+OFSETX                                   80386
         Y=PPP(2)*SFACTR/PPP(3)+OFSETY                                    80386
         IF(LFLAG.EQ.1) GO TO 350                                         80386
         IF (X.GE.XMIN.AND.X.LE.XMAX.AND.                                 80386
     1         Y.GE.YMIN.AND.Y.LE.YMAX)    GO TO 261                      80386
           CALL CLIP(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,ITWO,IPLOT)        80386
```

```
              NEWPEN=-3                                                 80386
              GO TO 265                                                 80386
 261     CONTINUE                                                       80386
              IF (IPNT.NE.1)                                            80386
     1        CALL PREPLT(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,IPEN,NEWPEN)80386
              CALL PLOT(X,Y,2)                                          80386
              IPLOT=1                                                   80386
              NEWPEN=3                                                  80386
 265     CONTINUE                                                       80386
              IPEN=3                                                    80386
              XSAV=X                                                    80386
              YSAV=Y                                                    80386
              LFLAG=1                                                   80386
              GO TO 100                                                 80386
 350     CONTINUE                                                       80386
         IF (X.GE.XMIN.AND.X.LE.XMAX.AND.                               80386
     1       Y.GE.YMIN.AND.Y.LE.YMAX)    GO TO 351                      80386
              CALL CLIP(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,ITHREE,IPLOT) 80386
              NEWPEN=-2                                                 80386
              IPEN=3                                                    80386
              GO TO 355                                                 80386
 351     CONTINUE                                                       80386
              IF (IPNT.NE.1)                                            80386
     1        CALL PREPLT(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,IPEN,NEWPEN)80386
              CALL PLOT(X,Y,3)                                          80386
              IPLOT=1                                                   80386
              NEWPEN=2                                                  80386
              IPEN=2                                                    80386
 355     CONTINUE                                                       80386
              XSAV=X                                                    80386
              YSAV=Y                                                    80386
      ENDIF                                                             80386
   70 IF(IFLAG.EQ.1) THEN                                               80386
         IPEN=3                                                         80386
         LFLAG=1                                                        80386
         GO TO 100                                                      80386
      ENDIF                                                             80386
      LFLAG=2                                                               V1.1
      CALL TRANS1(SEG(1,IPNT),PPP)                                          V1.1
      X=-PPP(1)*SFACTR/PPP(3)+OFSETX                                        V1.1
      Y=PPP(2)*SFACTR/PPP(3)+OFSETY                                         V1.1
      IF (X.GE.XMIN.AND.X.LE.XMAX.AND.                                      V1.1
     1    Y.GE.YMIN.AND.Y.LE.YMAX)    GO TO 71                              V1.1
         CALL CLIP(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,IPEN,IPLOT)            V1.1
         NEWPEN=-2                                                          V1.1
         IPEN=3                                                             V1.1
         GO TO 75                                                           V1.1
 71   CONTINUE                                                              V1.1
         IF (IPNT.NE.1)                                                     V1.1
     1   CALL PREPLT(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,IPEN,NEWPEN)         V1.1
         CALL PLOT(X,Y,IPEN)                                                V1.1
         IPLOT=1                                                            V1.1
```

```
          NEWPEN=2                                                    V1.1
          IPEN=2                                                      V1.1
 75    CONTINUE                                                       V1.1
          XSAV=X                                                      V1.1
          YSAV=Y                                                      V1.1
  100 CONTINUE                                                        V1.1
      RETURN                                                          V1.1
      END                                                             V1.1
```

```
      SUBROUTINE POLYD                                                  V1.1
C                                                                       V1.1
C     POLYD GENERATES DIRECTION COSINE MATRICIES FOR THE POLYGONS.      V1.1
C        THE X AXIS OF THE POLYGON COORDINATE SYSTEM IS THE             V1.1
C        NORMAL VECTOR TO THE POLYGON SURFACE.                          V1.1
C      Y VECTOR IS ALIGNED WITH ONE OF THE POLYGON SIDES.               V1.1
C                                                                       V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),       V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                        V1.2
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),PO(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
      DIMENSION INDEX(6),D1(810)                                        V1.1
      EQUIVALENCE (D,D1)                                                V1.1
      DATA INDEX/3,6,7,1,2,5/                                           V1.1
      DO 100 L=1,NPLANE                                                 V1.1
      J=9*L+262                                                         V1.1
      DO 20 I=1,3                                                       V1.1
      D1(J+I+2)=P(I,2,L)-P(I,1,L)                                       V1.1
   20 D1(J+I+5)=P(I,3,L)-P(I,1,L)                                       V1.1
      CALL CROSS(D1(J+3),D1(J+6),D1(J))                                 V1.1
      SUMD1=0.0                                                         V1.1
      SUMD2=0.0                                                         V1.1
      DO 30 I=1,3                                                       V1.1
      SUMD1=SUMD1+D1(J+I-1)**2                                          V1.1
   30 SUMD2=SUMD2+D1(J+I+2)**2                                          V1.1
      SUMD1=SQRT(SUMD1)                                                 V1.1
      SUMD2=SQRT(SUMD2)                                                 V1.1
      DO 40 I=1,3                                                       V1.1
      D1(J+I-1)=D1(J+I-1)/SUMD1                                         V1.1
   40 D1(J+I+2)=D1(J+I+2)/SUMD2                                         V1.1
      CALL CROSS(D1(J),D1(J+3),D1(J+6))                                 V1.1
      DO 50 I=1,3                                                       V1.1
      TEMP=D1(INDEX(I)+J)                                               V1.1
      D1(INDEX(I)+J)=D1(INDEX(I+3)+J)                                   V1.1
   50 D1(INDEX(I+3)+J)=TEMP                                             V1.1
  100 CONTINUE                                                          V1.1
      DO 600  J=1,NPLANE                                                V1.1
      NUM = J + 30                                                      V1.1
      DO 600  K=1,3                                                     V1.1
  600 SEGLP(K,NUM) = P(K,1,J)                                           V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE PREPLT(X,Y,XSAV,YSAV,XMIN,XMAX,YMIN,YMAX,IPEN,NEWPEN)       V1.1
C************************************************************           V1.1
C                                                                        V1.1
C  THIS SUBROUTINE PERFORMS NECESSARY PEN MOVES FOR 1ST PLOT            V1.1
C  AFTER CLIPPING                                                        V1.1
C                                                                        V1.1
C************************************************************           V1.1
      LOGICAL XOFF,YOFF                                                  V1.1
      IF (NEWPEN.NE.-2) RETURN                                           V1.1
C                                                                        V1.1
C  OUTSIDE X AND/OR Y BOUNDARIES???                                      V1.1
C                                                                        V1.1
      XOFF=.FALSE.                                                       V1.1
      YOFF=.FALSE.                                                       V1.1
      IF (X.LT.XMIN.OR.XSAV.LT.XMIN.OR.                                  V1.1
     1    X.GT.XMAX.OR.XSAV.GT.XMAX)   XOFF=.TRUE.                      V1.1
      IF (Y.LT.YMIN.OR.YSAV.LT.YMIN.OR.                                  V1.1
     1    Y.GT.YMAX.OR.YSAV.GT.YMAX)   YOFF=.TRUE.                      V1.1
C                                                                        V1.1
C  DETERMINE IF OFF TOP,BOTTOM,RIGHT,OR LEFT SIDE OF PLOTTER            V1.1
C                                                                        V1.1
      IF (X.LT.XMIN.OR.XSAV.LT.XMIN) XLIMIT=XMIN                         V1.1
      IF (X.GT.XMAX.OR.XSAV.GT.XMAX) XLIMIT=XMAX                         V1.1
      IF (Y.LT.YMIN.OR.YSAV.LT.YMIN) YLIMIT=YMIN                         V1.1
      IF (Y.GT.YMAX.OR.YSAV.GT.YMAX) YLIMIT=YMAX                         V1.1
C                                                                        V1.1
C  GET X AND Y POINTS DEPENDING ON WHAT BOUNDARIES OVER                  V1.1
C                                                                        V1.1
      IF (XOFF) YTEMP=YINTCP(X,Y,XSAV,YSAV,XLIMIT)                       V1.1
      IF (.NOT.XOFF) YTEMP=YLIMIT                                        V1.1
      IF (YOFF) XTEMP=XINTCP(X,Y,XSAV,YSAV,YLIMIT)                       V1.1
      IF (.NOT.YOFF) XTEMP=XLIMIT                                        V1.1
C                                                                        V1.1
C  MOVE PEN UP TO THAT SPOT                                              V1.1
C                                                                        V1.1
      CALL PLOT(XTEMP,YTEMP,3)                                           V1.1
      IPEN=2                                                             V1.1
      RETURN                                                             V1.1
      END                                                                V1.1
```

```
      SUBROUTINE PRJELR                                                 V1.1
C    ********************************************                       V1.1
C                                                                       V1.1
C     THIS SUBROUTINE PROJECTS ELLIPSOIDS ONTO THE PROJECTION PLANE.    V1.1
C                                                                       V1.1
C    ********************************************                       V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),       V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                        V1.2
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),PO(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
       DIMENSION DD(3,3),DDD(3,3),SS(3),S(3)                            V1.1
      DIMENSION R(3,3),R2(2,3)                                          V1.1
      REAL LAMDA1,LAMDA2,M1,M2                                          V1.1
      IF(NSEG .EQ. 0)  RETURN                                           V1.1
      DO 100  I=1,NSEG                                                  V1.1
      CALL DOTT(D(1,1,I),DVP,DD,3,3,3)                                  V1.1
      CALL MAT(A(1,1,I),DD,DDD,3,3,3,3,3,3)                             V1.1
      CALL DOT(D(1,1,I),DDD,DD,3,3,3)                                   V1.1
      CALL MAT(DVP,DD,DDD,3,3,3,3,3,3)                                  V1.1
      DO 10  K=1,3                                                      V1.1
   10 SS(K) = SEGLP(K,I) - VP(K) + SEGLPO(K,I)                          V1.2
      CALL MAT(DVP,SS,S,3,3,1,3,3,3)                                    V1.1
      DO 30 II=1,3                                                      V1.1
      IF (ABS(S(II)).LT.1.E-11) S(II)=1.0                               V1.2
30    CONTINUE                                                          V1.1
C                                                                       V1.1
      CALL SOLVR(DDD(1,1),DDD(2,1),DDD(3,1),DDD(1,3),DDD(2,3),DDD(3,3), V1.1
     *DDD(1,1),DDD(1,3),S,R(1,1),R(3,1))                                V1.1
      CALL SOLVR(DDD(1,2),DDD(2,2),DDD(3,2),DDD(1,3),DDD(2,3),DDD(3,3), V1.1
     *DDD(2,2),DDD(2,3),S,R(2,2),R(3,2))                                V1.1
      CALL SOLVR(DDD(1,1)+DDD(1,2),DDD(2,1)+DDD(2,2),DDD(3,1)+DDD(3,2), V1.1
     *DDD(1,3),DDD(2,3),DDD(3,3),DDD(1,1)+2.0*DDD(1,2)+DDD(2,2),        V1.1
     *DDD(1,3)+DDD(2,3),S,R(1,3),R(3,3))                                V1.1
      R(2,1)=0.0                                                        V1.1
      R(1,2)=0.0                                                        V1.1
      R(2,3)=R(1,3)                                                     V1.1
      DO 15 IK=1,3                                                      V1.1
      DO 15 IJ=1,2                                                      V1.1
   15 R2(IJ,IK)=(S(IJ)+R(IJ,IK))/(S(3)+R(3,IK))-S(IJ)/S(3)              V1.1
      CALL SOLVA(R2,A11,A22,A12)                                        V1.1
      TEMP=(A11+A22)**2-4.0*(A11*A22-A12**2)                            V1.1
      IF(TEMP.LT.0.0) TEMP=0.0                                          V1.1
      TEMP=SQRT(TEMP)                                                   V1.1
      LAMDA1=(A11+A22+TEMP)/2.0                                         V1.1
      LAMDA2=(A11+A22-TEMP)/2.0                                         V1.1
      RX1=A12                                                           V1.1
      RY1=LAMDA1-A11                                                    V1.1
      RX2=LAMDA2-A22                                                    V1.1
      RY2=A12                                                           V1.1
      LAMDA1=ABS(LAMDA1)                                                V1.1
      LAMDA2=ABS(LAMDA2)                                                V1.1
      M1=SQRT(1.0/(LAMDA1*(RX1**2+RY1**2)))                             V1.1
```

```
      M2=SQRT(1.0/(LAMDA2*(RX2**2+RY2**2)))                              V1.1
      RX1=RX1*M1                                                         V1.1
      RX2=RX2*M2                                                         V1.1
      RY1=RY1*M1                                                         V1.1
      RY2=RY2*M2                                                         V1.1
      CONVEC(1,1,I)=-2.0*RX1                                             V1.1
      CONVEC(2,1,I)=-2.0*RY1                                             V1.1
      CONVEC(1,2,I)=-2.0*RX2                                             V1.1
      CONVEC(2,2,I)=-2.0*RY2                                             V1.1
      DO 20  IJ=1,2                                                      V1.1
      CONVEC(IJ,3,I) = -CONVEC(IJ,1,I)                                   V1.1
      CONVEC(IJ,4,I) = -CONVEC(IJ,2,I)                                   V1.1
   20 POS(IJ,I) = CONVEC(IJ,3,I)/2.0 + CONVEC(IJ,4,I)/2.0+S(IJ)/S(3)     V1.1
      NPPP(I)=4                                                          V1.1
      SIGN(I)=CONVEC(1,1,I)*CONVEC(2,2,I)-                               V1.1
     1CONVEC(2,1,I)*CONVEC(1,2,I)                                        V1.1
  100 CONTINUE                                                           V1.1
      RETURN                                                             V1.1
      END                                                                V1.1
```

```
      SUBROUTINE PRJPLY                                                 V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
C                                                                       V1.1
C        THIS SUBROUTINE WILL SETUP THE CONVEC ARRAY.                   V1.1
C        IT ALSO SETS UP THE POS AND SIGN ARRAYS.                       V1.1
C                                                                       V1.1
C          ARRAY P IS THE ORIGINAL POSITION VECTORS FOR THE POLYGONS    V1.1
C           IN THE INERTIAL REFERENCE SYSTEM.                           V1.1
C          ARRAY CONVEC WILL CONTAIN THE CONTOUR VECTORS                V1.1
C           FOR PROJECTED POLYGONS.                                     V1.1
C          ARRAY POS WILL CONTAIN POSITION VECTORS FROM THE             V1.1
C           PROJECTION PLANE ORIGIN TO POLYGON POINT # 1.               V1.1
C          ARRAY SIGN WILL CONTAIN THE SIGN THAT RESULTS FROM           V1.1
C           THE CROSS PRODUCT (P2-P1)X(P3-P2).                          V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),PO(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),       V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                        V1.2
      DIMENSION PPP2(3),PP2(3),PP1(3)                                   V1.1
      IF(NPLANE.EQ.0) RETURN                                            V1.1
      DO 40 I=1,NPLANE                                                  V1.1
      II=I+30                                                           V1.1
      NPTS=NPPP(II)                                                     V1.1
      DO 35 K=1,NPTS                                                    V1.1
      DO 10 J=1,3                                                       V1.1
      PPP2(J)=P(J,K,I)-VP(J)                                            V1.1
   10 CONTINUE                                                          V1.1
      CALL MAT(DVP,PPP2,PP2,3,3,1,3,3,3)                                V1.1
      IF(K.NE.1) GO TO 16                                               V1.1
      DO 15 J=1,2                                                       V1.1
      POS(J,II)=PP2(J)/PP2(3)                                           V1.1
   15 CONTINUE                                                          V1.1
      GO TO 25                                                          V1.1
   16 DO 20 J=1,2                                                       V1.1
   20 CONVEC(J,K-1,II)=PP2(J)/PP2(3)-PP1(J)/PP1(3)                      V1.1
   25 DO 30 J=1,3                                                       V1.1
   30 PP1(J)=PP2(J)                                                     V1.1
      IF(K.EQ.3) SIGN(II)=CONVEC(1,1,II)*CONVEC(2,2,II)-                V1.1
     1CONVEC(2,1,II)*CONVEC(1,2,II)                                     V1.1
   35 CONTINUE                                                          V1.1
      DO 40 J=1,2                                                       V1.1
      CONVEC(J,NPTS,II)=POS(J,II)-PP2(J)/PP2(3)                         V1.1
   40 CONTINUE                                                          V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE PSE(X1,IN,SEG,INDEX,INDEX2,IHALF)                V1.1
      DIMENSION X1(3,INDEX,INDEX),IN(INDEX),SEG(3,3333)           V1.1
C                                                                 V1.1
C        THIS SUBROUTINE PLOTS A SEMIELLIPSOID.                   V1.1
C       THE HALF OF THE ELLIPSOID PLOTTED DEPENDS UPON IHALF.     V1.1
C          IF IHALF = 1 X .GE. 0 IS PLOTTED.                      V1.1
C          IF IHALF = 2 X .LT. 0 IS PLOTTED.                      V1.1
      DO 100 I=IHALF,INDEX                                        V1.1
      LINE=INDEX-I+1                                              V1.1
      IF(IHALF.EQ.2) LINE=I                                       V1.1
      NPTS=IN(LINE)                                               V1.1
      DO 50 K=1,NPTS                                              V1.1
      DO 50 J=1,3                                                 V1.1
      SEG(J,K)=X1(J,K,LINE)                                       V1.1
      IF(IHALF.EQ.2.AND.J.EQ.1) SEG(J,K)=-SEG(J,K)                V1.1
   50 CONTINUE                                                    V1.1
      N=NPTS                                                      V1.1
      IF(LINE.EQ.INDEX) GO TO 71                                  V1.1
      NPT=NPTS-1                                                  V1.1
      DO 60 K=1,NPT                                               V1.1
      KK=NPT-K+1                                                  V1.1
      N=N+1                                                       V1.1
      SEG(1,N)=SEG(1,KK)                                          V1.1
      SEG(2,N)=SEG(2,KK)                                          V1.1
   60 SEG(3,N)=-SEG(3,KK)                                         V1.1
      NPT=N-1                                                     V1.1
      DO 70 K=1,NPT                                               V1.1
      KK=NPT-K+1                                                  V1.1
      N=N+1                                                       V1.1
      SEG(1,N)=SEG(1,KK)                                          V1.1
      SEG(2,N)=-SEG(2,KK)                                         V1.1
   70 SEG(3,N)=SEG(3,KK)                                          V1.1
   71 IPEN=3                                                      V1.1
      CALL PNTPLT(SEG,IPEN,INDEX2,N)                              V1.1
  100 CONTINUE                                                    V1.1
      RETURN                                                      V1.1
      END                                                         V1.1
```

```
      SUBROUTINE ROT(A,L,TH,M)                                          V1.1
C                                                      REV 01 08/10/72  V1.1
C     COMPUTES ROTATION MATRIX A FOR ANGLE TH                           V1.1
C     ABOUT X,Y OR Z AXIS AS L = 1,2, OR 3.                             V1.1
C                                                                       V1.1
C       ARGUMENTS:                                                      V1.1
C         A: 3X3 ROTATION MATRIX TO BE COMPUTED.                        V1.1
C         L: 1,2 OR 3 TO ROTATE ABOUT X,Y OR Z AXIS.                    V1.1
C         TH: ANGLE OF ROTATION IN RADIANS.                             V1.1
C         M: 1ST DIMENSION OF A IN CALLING PROGRAM.                     V1.1
C                                                                       V1.1
      DIMENSION A(M,3)                                                  V1.1
      C= COS(TH)                                                        V1.1
      S= SIN(TH)                                                        V1.1
      IF (L.EQ.2) S = -S                                                V1.1
      DO 30 I=1,3                                                       V1.1
      IF(I.EQ.3)GO TO 20                                                V1.1
      DO 10 J=I,2                                                       V1.1
      A(I,J+1)=0.0                                                      V1.1
      A(J+1,I)=0.0                                                      V1.1
      IF(I+J+L.NE.5)GO TO 10                                            V1.1
      A(I,J+1)=S                                                        V1.1
      A(J+1,I)=-S                                                       V1.1
   10 CONTINUE                                                          V1.1
   20 A(I,I)= C                                                         V1.1
      IF(I.EQ.L)A(I,I)=1.0                                              V1.1
   30 CONTINUE                                                          V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE SOLVA(R,AA11,AA22,AA12)                              V1.1
      DIMENSION R(2,3)                                                V1.1
      A11=R(1,1)**2                                                   V1.1
      A12=2.0*R(2,1)*R(1,1)                                           V1.1
      A13=R(2,1)**2                                                   V1.1
      A21=R(1,2)**2                                                   V1.1
      A22=2.0*R(2,2)*R(1,2)                                           V1.1
      A23=R(2,2)**2                                                   V1.1
      A31=R(1,3)**2                                                   V1.1
      A32=2.0*R(2,3)*R(1,3)                                           V1.1
      A33=R(2,3)**2                                                   V1.1
      DEL=A11*(A22*A33-A23*A32)-A12*(A21*A33-A23*A31)+                V1.1
     1A13*(A21*A32-A22*A31)                                           V1.1
      AA11=((A22-A12)*(A33-A23)-(A23-A13)*(A32-A22))/DEL              V1.1
      AA12=((A23-A13)*(A31-A21)-(A21-A11)*(A33-A23))/DEL              V1.1
      AA22=((A21-A11)*(A32-A22)-(A22-A12)*(A31-A21))/DEL              V1.1
      IF(ABS(AA12).LT.1.E-11) AA12=.000001                            V1.2
      RETURN                                                          V1.1
      END                                                             V1.1
```

```
      SUBROUTINE SOLVR(A1,A2,A3,A4,A5,A6,A7,A8,P,RX,RZ)                 V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
C                                                                       V1.1
C        THIS SUBROUTINE WILL SOLVE A SET OF SIMULTANEOUS EQUATIONS     V1.1
C       TO FIND COMPONETS OF VECTOR R THAT SATISFY THE PROPERTIES NEEDED V1.1
C      TO DETURMINE THE EQUATION OF THE PROJECTED ELLIPSE.              V1.1
C                                                                       V1.1
C            SEE WRITEUP.                                               V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
      DIMENSION P(3)                                                    V1.1
      B=A1*P(1)+A2*P(2)+A3*P(3)                                         V1.1
      D=A4*P(1)+A5*P(2)+A6*P(3)                                         V1.1
      T1=A7*(D/B)**2+A6-2.0*A8*D/B                                      V1.1
      T2=2.0*A7*D/(B)**2-2.0*A8/B                                       V1.1
      T3=A7*(1/B)**2-1                                                  V1.1
        RZ=(-T2+SQRT(T2**2-4.0*T1*T3))/(2.0*T1)                         V1.1
      RX=-D*RZ/B-1.0/B                                                  V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE TITLE                                                   V1.1
      DIMENSION ICOLOR(21)                                             80386
      CHARACTER*4 ID(10,20)                                            80386
      COMMON/DBUG/IDEBUG(80),NISG,DEVFLG,ONLINE,TERM,BDRS,OFLINE          V1.1
      INTEGER ONLINE,DEVFLG,TERM,BDRS,OFLINE                             V1.1
      NLINE=20                                                           V1.1
      SIZE=.335                                                          V1.1
      X=1.375                                                            V1.1
      Y=10.0                                                             V1.1
C                                                                        V1.1
C     INITIALIZE PLOTTING PACKAGE                                        V1.1
C                                                                        V1.1
      CALL PLOT(0.0,0.0,-3)                                              V1.1
      READ(5,1) NFRME,ICOLOR(21)                                         V1.1
 1    FORMAT(I2,I2)                                                      V1.1
      IF(NFRME.EQ.0) RETURN                                              V1.1
      DO 300 K=1,NFRME                                                   V1.1
      DO 50 I=1,NLINE                                                    V1.1
      READ(5,200) (ID(J,I),J=1,8),ICOLOR(I)                              V1.1
      WRITE(6,200) (ID(J,I),J=1,8),ICOLOR(I)                             V1.1
 200  FORMAT(7A4,A2,I2)                                                  V1.1
  50  CONTINUE                                                           V1.1
      DO 100 I=1,NLINE                                                   V1.1
      Y=Y-.5                                                             V1.1
      IF(DEVFLG.EQ.OFLINE.OR.DEVFLG.EQ.BDRS) CALL COLOR(ICOLOR(I),IERR) 80386
      CALL SYMBOL(X,Y,SIZE,ID(1,I),0.,30)                                V1.1
 100  CONTINUE                                                           V1.1
      IF(DEVFLG.EQ.ONLINE) CALL PLOT(12.,0.,-3)                          V1.1
      IF(DEVFLG.EQ.TERM) CALL PLOT(0.0,0.0,-3)                           V1.1
      IF(DEVFLG.EQ.BDRS) CALL NFRAME                                     V1.1
      IF(DEVFLG.EQ.OFLINE) CALL PLOT (14.,0.,-3)                         V1.1
 300  CONTINUE                                                           V1.1
      RETURN                                                             V1.1
      END                                                                V1.1
```

```
      SUBROUTINE TPOINT(PP2,I,IN)                                       V1.1
      DIMENSION PP2(3),R(3),PP1(3)                                      V1.1
      COMMON/POLYGON/NPLANE,IFLAG,NPPP(90),P0(3,4,60),P(3,4,60),        V1.1
     *CONVEC(2,4,90),POS(2,90),SIGN(90)                                 V1.1
C                                                                       V1.1
C        THIS SUBROUTINE TESTS A POINT ON THE PROJECTION PLANE          V1.1
C       DEFINED BY PP2 AGAINST A POLYGON ON THE PROJECTION PLANE        V1.1
C       DEFINED BY I. A FLAG 'IN' IS RETURNED TO INDICATE IF THE        V1.1
C       POINT WAS INSIDE OR OUTSIDE THE POLYGON.                        V1.1
C                                                                       V1.1
C              IN = 1 POINT WAS INSIDE POLYGON                          V1.1
C                                                                       V1.1
C              IN = 2 POINT WAS OUTSIDE POLYGON                         V1.1
C                                                                       V1.1
      IN=1                                                              V1.1
      NPTS1=NPPP(I)                                                     V1.1
      DO 20 JJ=1,2                                                      V1.1
   20 PP1(JJ)=POS(JJ,I)                                                 V1.1
      DO 100 L=1,NPTS1                                                  V1.1
      DO 30 N=1,2                                                       V1.1
   30 R(N)=PP2(N)-PP1(N)                                                V1.1
      SIGN2=CONVEC(1,L,I)*R(2)-CONVEC(2,L,I)*R(1)                       V1.1
      IF(SIGN2*SIGN(I) .LT. 0.)  GO TO 150                              V1.1
      IF(ABS(SIGN2*SIGN(I)).LT.1.E-11) GO TO 150                        V1.1
      DO 100 N=1,2                                                      V1.1
  100 PP1(N)=PP1(N)+CONVEC(N,L,I)                                       V1.1
      RETURN                                                            V1.1
  150 IN=2                                                              V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE TRANS1(R,P)                                                  V1.1
      COMMON/ELLIPSE/NSTEPS(90),IELP,A(3,3,30),SEGLP(3,90),VP(3),             V1.1
     *D(3,3,90),DVP(3,3),RA(3),NSEG,SEGLPO(3,90)                              V1.2
      COMMON/VIEWP/VPO(3),DVPO(3,3),IVP,VP2(3)                                V1.1
      DIMENSION DD(3,3),P(3),R(3),R2(3),SEGLP2(3),S(3)                        V1.2
      IF(IELP .GT. 30)  GO TO 10                                              V1.1
      CALL DOTT(DVP,D(1,1,IELP),DD,3,3,3)                                     V1.1
   20 CONTINUE                                                                V1.1
      CALL MAT(DD,R,R2,3,3,1,3,3,3)                                           V1.1
      DO 2 I=1,3                                                              V1.2
2     S(I) = SEGLP(I,IELP) + SEGLPO(I,IELP)                                   V1.2
      CALL MAT(DVP,S,SEGLP2,3,3,1,3,3,3)                                      V1.2
      DO 1  I=1,3                                                             V1.1
    1 P(I)=SEGLP2(I)+R2(I)-VP2(I)                                             V1.1
      RETURN                                                                  V1.1
   10 DO 11  I=1,3                                                            V1.1
      DO 11  J=1,3                                                            V1.1
   11 DD(I,J) = DVP(I,J)                                                      V1.1
      GO TO 20                                                                V1.1
      END                                                                     V1.1
```

```
      REAL FUNCTION XINTCP(X,Y,XSAV,YSAV,YTEMP)                               V1.1
C   ********************************************                              V1.1
C                                                                             V1.1
C  THIS FUNCTION CALCULATES THE X INTERCEPT AT YTEMP                          V1.1
C                                                                             V1.1
C   ********************************************                              V1.1
      X1=X-XSAV                                                               V1.1
      Y1=Y-YSAV                                                               V1.1
      IF (Y1.NE.0.0) PFACTR=X1/Y1                                             V1.1
      IF (ABS(Y1).LT.1.E-11) PFACTR=0.0                                       V1.2
      Y2=YTEMP-YSAV                                                           V1.1
      XINTCP=Y2*PFACTR+XSAV                                                   V1.1
      RETURN                                                                  V1.1
      END                                                                     V1.1
```

```
      SUBROUTINE XYZ(MU,A,B,C,S,M,JFLAG)                                V1.1
      DIMENSION MU(3),S(3),M(3,2)                                       V1.1
      REAL M,MU                                                         V1.1
C                                                                       V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
C       ALPHA AND BETA RELATE THE Y AND Z COMPONENTS OF M TO            V1.1
C        THE X COMPONENT OF M.                                          V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
      ALPHA = MU(2) / MU(1)                                             V1.1
      BETA = MU(3) / MU(1)                                              V1.1
C                                                                       V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
C       SOLVE THE EQUATION FOR ELLIPSE 'N' TO FIND A POINT ON           V1.1
C        THE ELLIPSE THAT WILL DETERMINE A VECTOR M.                    V1.1
C                                                                       V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
      T1=A+B*ALPHA*ALPHA+C*BETA*BETA                                    V1.1
      T2=2*A*S(1)+2*B*ALPHA*S(2)+2*C*BETA*S(3)                          V1.1
      T3=A*S(1)**2+B*S(2)**2+C*S(3)**2-1                                V1.1
      TEMP= T2 * T2 - 4 * T1 * T3                                       V1.1
C                                                                       V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
C       NO SOLUTION MEANS ELLIPSOID 'N' NOT TOUCHED BY LINE OF          V1.1
C        SIGHT RAY.                                                     V1.1
C                                                                       V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
      IF(TEMP.LT.0.0) GO TO 2                                           V1.1
      TEMP=SQRT(TEMP)                                                   V1.1
C                                                                       V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
C       FIND TWO POSSIBLE M VECTORS BECAUSE A RAY ENTERING A            V1.1
C        SOLID MUST ALSO LEAVE.                                         V1.1
C                                                                       V1.1
C    *****************************************************************  V1.1
C                                                                       V1.1
      M(1,1)=(T2+TEMP)/(2*T1)                                           V1.1
      M(2,1)=ALPHA*M(1,1)                                               V1.1
      M(3,1)=BETA*M(1,1)                                                V1.1
      M(1,2)=(T2-TEMP)/(2*T1)                                           V1.1
      M(2,2)=ALPHA*M(1,2)                                               V1.1
      M(3,2)=BETA*M(1,2)                                                V1.1
      JFLAG=0                                                           V1.1
      RETURN                                                            V1.1
    2 JFLAG=1                                                           V1.1
      RETURN                                                            V1.1
```

```
      END                                                          V1.1
```

```
      REAL FUNCTION YINTCP(X,Y,XSAV,YSAV,XTEMP)                         V1.1
C  *************************************************                   V1.1
C                                                                       V1.1
C  THIS FUNCTION CALCULATES THE Y INTERCEPT AT XTEMP                    V1.1
C                                                                       V1.1
C  ************************************************8                   V1.1
      X1=X-XSAV                                                         V1.1
      Y1=Y-YSAV                                                         V1.1
      IF (X1.NE.0.0) PFACTR=Y1/X1                                       V1.1
      IF (ABS(X1).LT.1.E-11) PFACTR=0.0                                 V1.2
      X2=XTEMP-XSAV                                                     V1.1
      YINTCP=X2*PFACTR+YSAV                                             V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE YZ(MU,A,B,C,S,M,JFLAG)                                 V1.1
      DIMENSION MU(3),S(3),M(3,2)                                       V1.1
      REAL MU,M                                                         V1.1
C        ****************************************                       V1.1
C                                                                       V1.1
C        ALPHA RELATES THE Z COMPONET TO THE Y COMPONET                 V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
      ALPHA=MU(3)/MU(2)                                                 V1.1
C        ****************************************                       V1.1
C                                                                       V1.1
C        SOLVE THE EQUATION FOR ELLIPSE 'N' WHEN X=0 TO                 V1.1
C       FIND A POINT ON THE ELLIPSE THAT WILL DETERMINE A VECTOR M.     V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
      T1=B+C*ALPHA*ALPHA                                                V1.1
      T2=2*B*S(2)+2*C*ALPHA*S(3)                                        V1.1
      T3=A*S(1)**2+B*S(2)**2+C*S(3)**2-1                                V1.1
      TEMP=T2*T2-4*T1*T3                                                V1.1
C        ****************************************                       V1.1
C                                                                       V1.1
C        NO SOLUTION MEANS ELLIPSOID 'N' NOT TOUCHED BY LINE            V1.1
C       OF SIGHT RAY.                                                   V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
      IF(TEMP.LT.0.0) GO TO 2                                           V1.1
      TEMP=SQRT(TEMP)                                                   V1.1
C        ****************************************                       V1.1
C                                                                       V1.1
C        FIND TWO POSSIBLE M VECTORS BECAUSE A RAY ENTERING             V1.1
C       A SOLID MUST ALSO LEAVE.                                        V1.1
C                                                                       V1.1
C        ****************************************                       V1.1
      M(2,1)=(T2+TEMP)/(2*T1)                                           V1.1
      M(1,1)=0.0                                                        V1.1
      M(3,1)=ALPHA*M(2,1)                                               V1.1
      M(2,2)=(T2-TEMP)/(2*T1)                                           V1.1
      M(1,2)=0.0                                                        V1.1
      M(3,2)=ALPHA*M(2,2)                                               V1.1
      JFLAG=0                                                           V1.1
      RETURN                                                            V1.1
    2 JFLAG=1                                                           V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```

```
      SUBROUTINE Z(MU,A,B,C,S,M,JFLAG)                                  V1.1
      DIMENSION MU(3),S(3),M(3,2)                                       V1.1
      REAL M,MU                                                         V1.1
C         ******************************************                    V1.1
C                                                                       V1.1
C         SOLVE THE EQUATION FOR ELLIPSE 'N' WHEN X=0 AND               V1.1
C       Y=0 TO FIND A POINT ON THE ELLIPSE THAT                         V1.1
C       WILL DETERMINE A VECTOR M.                                      V1.1
C                                                                       V1.1
C         ******************************************                    V1.1
      T1=C                                                              V1.1
      T2=2*C*S(3)                                                       V1.1
      T3=A*S(1)**2+B*S(2)**2+C*S(3)**2-1                                V1.1
      TEMP=T2*T2-4*T1*T3                                                V1.1
C         ******************************************                    V1.1
C                                                                       V1.1
C         NO SOLUTION MEANS ELLIPSOID 'N' NOT TOUCHED BY LINE           V1.1
C       OF SIGHT RAY.                                                   V1.1
C                                                                       V1.1
C         ******************************************                    V1.1
      IF(TEMP.LT.0.0) GO TO 2                                           V1.1
      TEMP=SQRT(TEMP)                                                   V1.1
C         ******************************************                    V1.1
C                                                                       V1.1
C         FIND TWO POSSIBLE M VECTORS BECAUSE A RAY ENTERING            V1.1
C       A SOLID MUST ALSO LEAVE.                                        V1.1
C                                                                       V1.1
C         ******************************************                    V1.1
      M(1,1)=0.0                                                        V1.1
      M(2,1)=0.0                                                        V1.1
      M(3,1)=(T2+TEMP)/(2*T1)                                           V1.1
      M(1,2)=0.0                                                        V1.1
      M(2,2)=0.0                                                        V1.1
      M(3,2)=(T2-TEMP)/(2*T1)                                           V1.1
      JFLAG=0                                                           V1.1
      RETURN                                                            V1.1
    2 JFLAG=1                                                           V1.1
      RETURN                                                            V1.1
      END                                                               V1.1
```